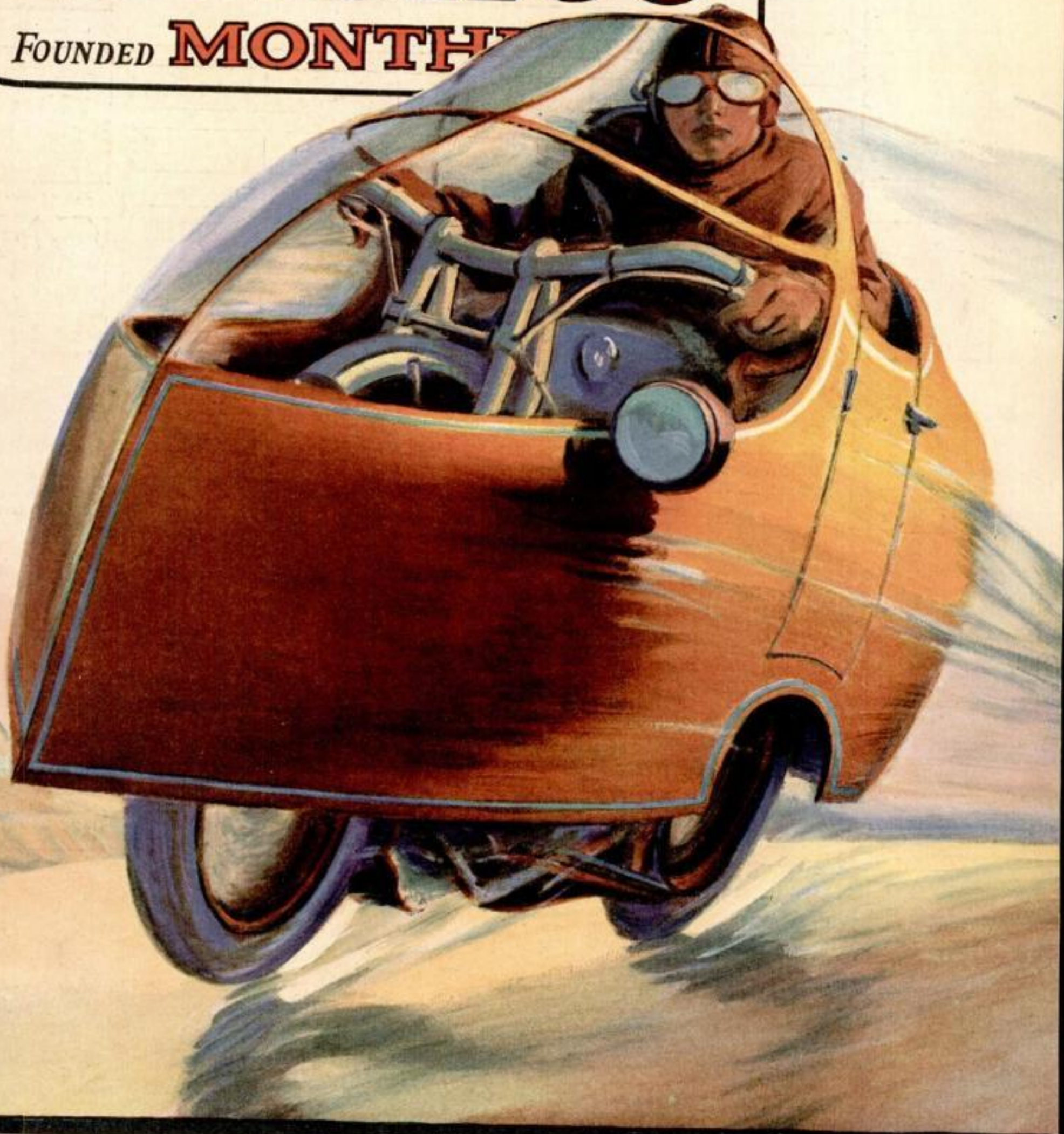


Reg. U.S. Pat. Off.

Popular Science

FOUNDED MONTHLY



New Ideas for Motorcycle Comfort (See page 42)
ARCH
Most Wonderfully Illustrated Magazine in the World
25 CENTS



For permanence and beauty



To protect its beauty



To "insure" your roof



To "renew" your car



For lasting attractiveness



To resist wear



To save your screens



To keep attractive

CONDENSED HOUSEHOLD GUIDE				
For Painting, Varnishing, Staining and Enameling				
IMPORTANT: Each of the products specified below bears our name and trade mark				
SURFACE	TO PAINT— USE PRODUCT NAMED BELOW	TO VARNISH— USE PRODUCT NAMED BELOW	TO STAIN— USE PRODUCT NAMED BELOW	TO ENAMEL— USE PRODUCT NAMED BELOW
AUTOMOBILES.....	S-W Auto Enamel	S-W Auto Enamel Clear		S-W Auto Enamel
AUTOMOBILE TOPS AND SEATS.....	S-W Auto Top and S-W Auto Seat Dressing			
BRICK.....	SWP House Paint S-W Concrete Wall Finish			Old Dutch Enamel
CEILINGS, Interior	Flat-Tone	Scar-Not Varnish	S-W Handcraft Stain Floorlac	Enameloid
Exterior	SWP House Paint	Rexpar Varnish	S-W Oil Stain	Old Dutch Enamel
CONCRETE.....	S-W Concrete Wall Finish			
DOORS, Interior.....	SWP House Paint	Scar-Not Varnish Velvet Finish No. 1044	Floorlac S-W Handcraft Stain	Enameloid
Exterior.....	SWP House Paint	Rexpar Varnish	S-W Oil Stain	Old Dutch Enamel
FENCES.....	SWP House Paint Metalastic S-W Roof and Bridge Paint		S-W Preservative Shingle Stain	
FLOORS, Interior (wood).....	S-W Inside Floor Paint	Mar-Not Varnish	Floorlac	S-W Inside Floor Paint
Concrete.....	S-W Concrete Floor Finish			S-W Concrete Floor Finish
Porch.....	S-W Porch and Deck Paint			
FURNITURE, Indoors	Enameloid	Scar-Not Varnish	Floorlac	Old Dutch Enamel Enameloid
Porch.....	Enameloid	Rexpar Varnish	S-W Oil Stain	Old Dutch Enamel
HOUSE OR GARAGE Exterior.....	SWP House Paint	Rexpar Varnish	S-W Preservative Shingle Stain	Old Dutch Enamel
LINOLEUM.....	S-W Inside Floor Paint	Mar-Not Varnish		S-W Inside Floor Paint
RADIATORS.....	Flat-Tone S-W Aluminum or Gold Paint			Enameloid
ROOFS, Shingle.....	S-W Roof and Bridge Paint		S-W Preservative Shingle Stain	
Metal.....	Metalastic			
Composition.....	Ebonol			
SCREENS.....	S-W Screen Enamel			S-W Screen Enamel
TOYS.....	S-W Family Paint	Rexpar Varnish	Floorlac	Enameloid
WALLS, Interior (Plaster or Wallboard)	Flat-Tone SWP House Paint			Old Dutch Enamel Enameloid
WICKER.....	Enameloid	Rexpar Varnish	Floorlac	Old Dutch Enamel
WOODWORK Interior.....	SWP House Paint Flat-Tone	Scar-Not Varnish Velvet Finish No. 1044	S-W Handcraft Stain S-W Oil Stain Floorlac	Old Dutch Enamel Enameloid

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NOTE: Best results can be had by following the carefully prepared directions on labels.



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Have it handy for reference. It tells the exactly correct paint, varnish, stain or enamel for successful work throughout your home.

Write for free booklet B 450 with complete Household Guide and helpful information on all painting, varnishing, staining and enameling. Valuable whether you do the work yourself or employ a master painter.

The "Guide" covers the more common problems. If you have some finishing problems not covered by the "Guide," write us. It will pay you to visit the nearest Sherwin-Williams dealer and consult the more extensive "Guide" shown in his store.

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To enrich hard wood



For cheerful satisfactory walls



To keep linoleum like new



For stucco



To properly finish woodwork



For better-looking radiators



To make toys "new"



To withstand the weather

The COURT JESTER of TODAY

"No wit to flatter left of all his store,
No fool to laugh at, which he valued more."
—Pope

SINCE the earliest days, laughter and gaiety have been the most sought after things in life. In ancient times stately rulers unbent, courtly knights forgot seriousness; beautiful ladies became more alluring as the clever quips and merry pranks of the court jester brought a sparkle to their eyes and drove dull care away. But they were limited to the clownish antics and slapstick comedy of the jester.

Moderns have unlimited sources of amusement. Every broadcasting station has its Jester; its humorous stories; amusing songs and clever comedies. Each night the air is filled with merriment.

With a Crosley Model X-J radio receiver, amusement may be brought clearly and distinctly to your fireside. Sitting comfortably in an easy chair you forget dull care. The magic wand of the radio sends worry scurrying.

The very moderate prices of all Crosley instruments bring radio within the reach of all. No matter which Crosley Model you may select you can be assured of the maximum results at the lowest cost.

Let a Crosley Radio Receiver bring fun, laughter and good humor into your home.

CROSLEY
Better-Cost Less
Radio Products

See the Crosley Line at Good Dealers Everywhere

Write for Free Catalog. This fully describes the Crosley line of Radio receivers which range in price from the Model VI, a 2 tube set at \$30, to the graceful Console Model X-L at \$140. It also shows the complete line of Crosley parts.



Crosley Model X-J—Price \$65

For tuning out local interference and bringing in distant stations this receiver is unexcelled. It is a 4 tube set combining one stage of tuned radio frequency amplification, detector and two stages of audio frequency amplification. For bringing in distant stations no set can excel it. Cost of necessary accessories \$40.00 and up.

THE CROSLEY RADIO CORPORATION

Powel Crosley Jr., President

Formerly called the Precision Equipment Company and
Crosley Manufacturing Company

317 Alfred Street

Cincinnati, Ohio

The Largest Manufacturers of Radio Receivers in the World



CROSLEY \$
Model X-J 65

CROSLEY MANUFACTURING COMPANY Owns and
Operates Broadcasting Station WLW

MAIL THIS COUPON TODAY

The Crosley Radio Corporation,
317 Alfred St., Cincinnati, O.

Gentlemen: Please mail me free of charge your complete catalog of Crosley instruments and parts.

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POPULAR SCIENCE MONTHLY

Most Wonderfully Illustrated Magazine in the World

MARCH, 1924; Vol. 104, No. 3
25 cents a Copy; \$2.50 a Year



Published in New York City at
225 West Thirty-ninth Street

SCIENCE constantly is providing us with new thrills—new drama. Consider the proposed flight of the *Shenandoah* to the North Pole, of which Fitzhugh Green writes on page 31 of this issue.

Such a flight may prove the greatest venture into the unknown since the voyage of Columbus. When attempted, it will open up a whole new chapter in arctic exploration. It is a project made possible by the gifts of science and the unselfish labor of scientists.

* *

THE flight itself is conceived for scientific purposes—to add to man's common knowledge of the world in which we live. Gold, oil, coal, a new continent—all are possible discoveries. And who knows but from this hazardous expedition may come some rare element, such as radium, that will revolutionize our lives?

* *

ON PAGE 37 Dr. James J. Walsh, able scientist, tells of discoveries in the mind that transcend the discoveries of science in metals and minerals, steam and electricity, chemistry and physics. In his stimulating article he points out how we can shape our habits for good or bad—for health, success, and happiness, or for failure, misery, and disappointment.

* *

AS YOU read his story, remember that the discoveries of science in the human mind are only beginning and are filled with enthusiastic expectations. Just as mineralogists are discovering new metals stored in the earth, psychologists, prospecting in the mind, are disclosing new and unsuspected mental and physical resources. One day psychology may show men how to transmit thoughts without words and without signs—by mental telepathy.

* *

SCIENCE has harnessed and directed the elements and has produced thousands of

wonderful machines to help us with our daily labors. More recently science has begun to pay attention to man's body. As a result, the life expectancy of the average man—yours and mine—has been lengthened a dozen years. On page 34 is a fascinating story of the experiments of Dr. E. V. McCollum in the influence of food upon bodily welfare. And on page 43 is Dr.

Reynold A. Spaeth's story of the search of science to determine and overcome the causes of human fatigue.

* *

WHAT about your physiological capital? A commercial credit man may take stock of you financially and find you have a comfortable reserve. But have you a comfortable physiological reserve? Or would a physiologist find that you are drawing on your reserve without replacements and are headed for physical bankruptcy?

* *

IF YOU would reflect on the progress of science, turn to Captain Frank Hurley's thrilling narrative of exploration on page 40. Notice the awe with which the cannibals of New Guinea regarded the first airplane they ever had seen. Then read Mr. W. K. Kellogg's intensely

personal story of his unusual automobile, page 49, the delightful account of Maude Adams' surprising success as an inventor of daylight color projection of motion pictures, page 45, and Jack Binns' article on secret and directional radio, page 71. And as you marvel at these modern agencies of communication, travel, and entertainment, remember that men are yet young who saw the first airplane, the first automobile, and the first radio set.

* *

THE possibilities in science for the future are boundless. The next generation may use bottled sunlight for light and heat, produce its food chemically, and employ atomic energy to drive the engines of industry.

In Next Month's Issue

Are You Planning a Home?—Phil Madison Riley, one of America's foremost writers on popular architecture, begins a series of fascinating adventures in home buying, building, and equipping.

The Headache Alarm—An able physician tells where head pains come from and why they are useful in warning us of defects in our machinery.

Radio Satisfaction—Jack Binns, American ace of radio writers, describes how to get maximum efficiency out of your receiving set.

"Black Flour"—An amazing account of the world's newest fuel—coal that can be piped, like gas, to the consumer.

And 200 other fascinating articles and pictures

POPULAR SCIENCE MONTHLY

Issued monthly. Single copy, 25 cents. Yearly subscription to United States, its possessions, and Canada, \$2.50; foreign countries, \$3.

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The contents of this magazine must not be reprinted without permission. H. J. Fisher, President; R. C. Wilson, Vice-President; O. B. Capen, Secretary and Treasurer



Can Success Like This Be An Accident?

"THE fellows who used to work with me while I was plugging along at \$25 a week are convinced that I either had a 'pull' or just 'fell into a good thing'—that my \$9,000 a year position is a sheer accident.

"When I told them I had found an easy way to earn big money as a salesman, they laughed at me and called it a 'hare-brained idea.' They told me 'salesmen are born, not made.' But I decided to see my harebrained idea 'through.' I was sick of slaving for a pittance.

"I started studying the secrets of master salesmanship as taught by the National Salesmen's Training Association—and almost before I knew it I had confidence to tackle my first selling position. And why not? I had mastered the very secrets of selling used by the most successful salesmen.

"My earnings during the past month were \$750. I now have better than a \$9,000 a year position—with lots more room to grow. I can state positively that my sudden success was not an accident. It came because I knew how to sell scientifically. And how simple it is to sell when you know how. My regret is that I did not know these secrets ten years ago."—Ellis Sumner Cook, Manufacturers Agent, 20 E. Jackson Blvd., Chicago, Ill.

Why Not Make More Money?

If you want to get out of the wage-earning class, if you want to make good money without loss of time—then do as Mr. Cook and thousands of others have done.

The secrets of salesmanship which Mr. Cook learned are available to you. There are certain ways to approach prospects, to stimulate interest, to overcome objections, and to close sales. Every move in selling is governed by certain rules. Once you know these success is yours.

Success Like This Yours

Adam Horneber, Bay City, Mich., writes: "I have increased my earning power 500 per cent since I

secured your training in the Science of Selling."

Lewis A. Tinnes, Minneapolis, Minn., writes: "When I finished your training I left my job at \$160 a month and took a job as salesman. The first month I made over \$600 and I expect to go higher yet."

N. D. Miller, 1705 S. Clark Street, Chicago, says: "I place the credit for my success where it rightfully belongs. I owe my present position wholly to the N. S. T. A. In July, 1919, I studied your selling secrets and in September you secured me the position which I now hold. I am earning in excess of \$100 a week."

Employers

Are invited to write to the Employment Dept. of the N. S. T. A. We can put you in touch with just the men you need. No charge for this service to you or our members. Employers are also cordially invited to request details about the N. S. T. A. Group Plan of instruction for entire sales forces. Synopses and charts sent without obligation.



Bear in mind that these stories of real success—the kind that is waiting you in this field of unlimited money-making opportunities—are but a few of thousands on file. You will find scores of them in our literature.

Valuable Book Free

No matter what you may now think, it is only a thought. Get the facts! See for yourself how you can easily duplicate any of these stories of success. NOW and no other time is the minute to mail the coupon below. Our big free book, "Modern Salesmanship," will be mailed promptly. And there's no obligation.

NATIONAL SALESMEN'S TRAINING ASSOCIATION

Dept. 15-C, 53 W. Jackson Blvd., CHICAGO, ILL.



National Salesmen's Training Association
Dept. 15-C, 53 W. Jackson Blvd., Chicago, Ill.
Send me FREE your book "Modern Salesmanship," and proof that I can become a master salesman.

Name.....

Address.....

City..... State.....

Age..... Occupation.....

He Doesn't Know It Yet But He's a \$6,000 Man

"DO YOU SEE that earnest-looking fellow talking to the President?"

—It was the General Manager speaking; he and his guest were taking a turn thru the main offices.

—"That's the man I've got picked to take Short's place, as Auditor of the Company, when Short goes East. I've had my eye on him for more than a year; he's the kind of fellow who's bound to get ahead. I learned the other day that he has been studying evenings at home for the past six or eight months. He's one of the few men who really seem awake to their opportunities. A fellow like that is too good to lose, and we're going to make it worth his while to stick. He doesn't know it yet, but he's a six-thousand-dollar man!"

* * *

"Studying evenings—working out problems—taking an interest in the business"—if the men in subordinate positions could only read the minds of the men directing them, what surprising things they would learn about themselves!

—How every day, for example, those who show promise are being appraised for bigger jobs. —How their capacity is constantly being measured by the readiness with which they grasp the larger problems of the business. —How they are being gauged by the foresight they show in preparing for greater responsibilities.

For, after all, the extent to which a man is willing to *prepare* for bigger things is a mighty good index to his fitness to *control* them— isn't it?

The boss, you see—if he is a real executive and not a figurehead—put in many years equipping himself for his present position. Is it likely that he will overlook the chap who shows the same habits and tendencies which helped *him* to get ahead?

Then, too, when a man undertakes home-study training, he proves that he has good common-sense—and *that's* an asset!

For consider the logic of his undertaking—

For a comparatively few months—a year or two, at most—a man agrees with himself to give up a certain proportion of his "good times." He weighs them against his ambition to increase his income, and he deliberately chooses the bigger salary, the larger future. He knows that training is what he *needs*, and he values his self-respect so highly that he cannot be happy to drift any longer.



The point to all this is very simple. In making a decision of this kind, he is demonstrating his ability to discriminate between the values that are worth while and those that are no values at all.

And inevitably that kind of shrewdness makes a real hit with sound business men.

He Learns by Solving Problems —and It's a Fascinating Method

But there's another phase to home-study training which we have neglected to mention.

While it takes courage to map out a course for oneself and to make the start, it is only a short time after one has got under way when it becomes no task at all, and instead of regarding his studies as a burden, a man gets to really looking forward to his periods of training. Under

the LaSalle Problem Method, he works with actual business problems, and they fascinate him. He is conscious that he is growing in business power. He sees the results of his increased ability in the promotions that he gains.

Consider, for example, such simple statements as the following, all susceptible to ready proof:

"Salary and earnings have increased over 183 per cent. Your course has given me the position I wished for, the salary I looked for, and has broadened my knowledge and vision so that I have perfect confidence in my ability to do any job in the accounting field."

FRANK B. TRISCO,
Minnesota.

"Instead of a factory storekeeper, I find myself at the end of three years head of a department, with an increase in salary of 230 per cent."

F. H. LAWSON, California.

"Led the list in the Maine bar examination."

GORDON F. GALLERT,
Maine.

"From a salesman in the ranks, in two short months my sales have shot up nearly 150 per cent. I am now a district manager, with eleven men working under me."

C. RUTHERFORD, Canada.

"—a total of 90 per cent increase in salary in two years. I saw this promotion in advance and was preparing myself for it, altho it came six months sooner than expected, which goes to show that it pays to be prepared."

R. L. REEVES, Alabama.

Make Yourself a \$6,000 Man

Of course no amount of WISHING can get a man out of a mediocre place and put him on the right road to success.

But what astounding things a man can do if he changes his wishing to WILLING—if he really sets up a goal for himself and steadily bends his energies toward REACHING it!

What is YOUR goal? Is it symbolized by one or more of the courses listed on the coupon just below?

Then, for the sake of your future, take out your pencil NOW—check the training that appeals to you—sign your name and address—and put it in the mail.

There is, of course, no obligation—but there's a great big OPPORTUNITY—and it's automatically set aside for the man who ACTS.

LASALLE EXTENSION UNIVERSITY

The Largest Business Training Institution in the World

LASALLE EXTENSION UNIVERSITY Dept. 383-R CHICAGO, ILLINOIS

Please send me catalog and full information regarding the course and service I have marked with an X below. Also a copy of your book, "Ten Years' Promotion in One," all without obligation to me.

- | | | | |
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| <input type="checkbox"/> Business Management: Training for Official, Managerial, Sales and Executive positions. | <input type="checkbox"/> Traffic Management—Foreign and Domestic: Training for positions as Railroad or Industrial Traffic Manager, etc. | <input type="checkbox"/> Industrial Management Efficiency: For Executives, Managers, Office and Shop Employees and those desiring practical training in industrial management principles and practice. | <input type="checkbox"/> Expert Bookkeeping: Training for position as Head Bookkeeper. |
| <input type="checkbox"/> Modern Salesmanship: Training for Sales and Advertising Executives, Solicitors, Sales Promotion Managers, Salesmen, Manufacturers' Agents and all those engaged in retail, wholesale or specialty selling. | <input type="checkbox"/> Railway Station Management: Training for Station Accountants, Cashiers and Agents, Division Agents, Traveling Auditors, Transportation Inspectors, Traveling Freight Agents, etc. | <input type="checkbox"/> Personnel and Employment Management: Training for Employers, Employment Managers, Executives, Industrial Engineers. | <input type="checkbox"/> Business English: Training for Business Correspondents and Copy Writers. |
| <input type="checkbox"/> Higher Accountancy: Training for positions as Auditor, Comptroller, Certified Public Accountant, Cost Accountant, etc. | <input type="checkbox"/> Banking and Finance: Training for executive positions in Banks and Financial Institutions. | <input type="checkbox"/> Modern Business Correspondence and Practice: Training for Sales and Collection Correspondents; Sales Promotion Managers; Credit and Office Managers; Correspondence Supervisors, Secretaries, etc. | <input type="checkbox"/> Commercial Spanish: Training for positions as Foreign Correspondent with Spanish-speaking countries. |
| <input type="checkbox"/> Law: Training for Bar; LL. B. Degree. | <input type="checkbox"/> Modern Foremanship and Production Methods: Training in the direction and handling of Industrial forces—for Executives, Managers, Superintendents, Contractors, Foremen, Sub-foremen, etc. | | <input type="checkbox"/> Effective Speaking: Training in the art of forceful, effective speech for Ministers, Salesmen, Fraternal Leaders, Politicians, Clubmen, etc. |
| <input type="checkbox"/> Commercial Law: Reading, Reference and Consultation Service for Business Men. | | | <input type="checkbox"/> C. P. A. Coaching for Advanced Accountants. |

Name..... Present Position..... Address.....



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I Will Train You At Home

Stop right here. This is **YOUR** opportunity! Electricity is calling you, and the Electrical Business is in for a tremendous increase. But it needs more trained men—at big pay. By my **Home Study Course in Practical Electricity** I can train you for these positions.

FREE!

BIG ELECTRICAL OUTFIT

A fine outfit of Electrical Tools, Instruments, Materials, etc., absolutely **FREE** to every student. I will also send you **FREE** and fully Prepaid—Proof Lessons to show you how easily you can learn Electricity and enter this splendid profession by my new revised and original system of Training by Mail.

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Special newly-written wireless course worth \$45.00 given away **FREE**.

Free Use of Laboratory

I have a large splendidly equipped Electrical Laboratory where you can come at any time for special instruction without charge. Several competent assistants—practical engineers—are in charge.

Earn Money While Learning

I give you something you can use **now**. Early in my **Home Study Course** I show you how to begin making money in Electricity, and help you get started. No need to wait until the whole course is completed. Hundreds of students have made several times the cost of their course in spare time while learning.

Earn \$70 to \$200 a Week

You've always had a liking for Electricity and a hankering to do electrical jobs. Now is the time to develop that talent; there's big money in it. Even if you don't know anything at all about Electricity you can quickly grasp it by my up-to-date, practical method of teaching. You will find it intensely interesting and highly profitable. I've trained and started hundreds of men in the Electrical business, men who have made big successes. **YOU CAN ALSO**

BE A BIG PAID Electrical Expert

What are you doing to prepare yourself for a real success? At the rate you are going where will you be in ten years from now? Have you the specialized training that will put you on the road to success? Have you ambition enough to **prepare** for success, and get it?

You have the ambition and I will give you the training, so get **busy**. I am offering you **success** and all that goes with it. Will you take it? I'll make you an **ELECTRICAL EXPERT**. I will train you as you should be trained. I will give you the benefit of my advice and 20 years of engineering experience and help you in every way to the biggest possible success.

Valuable Book Free

My Book "How to Become an Electrical Expert," has started many a man on his way to fortune. I will send a copy free and prepaid to every person answering this advertisement!

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Act Now! Good intentions never get you anywhere. It is action, alone, that counts. **NOW IS THE TIME TO ACT.**

L. L. COOKE, Chief Engineer

Chicago Engineering Works

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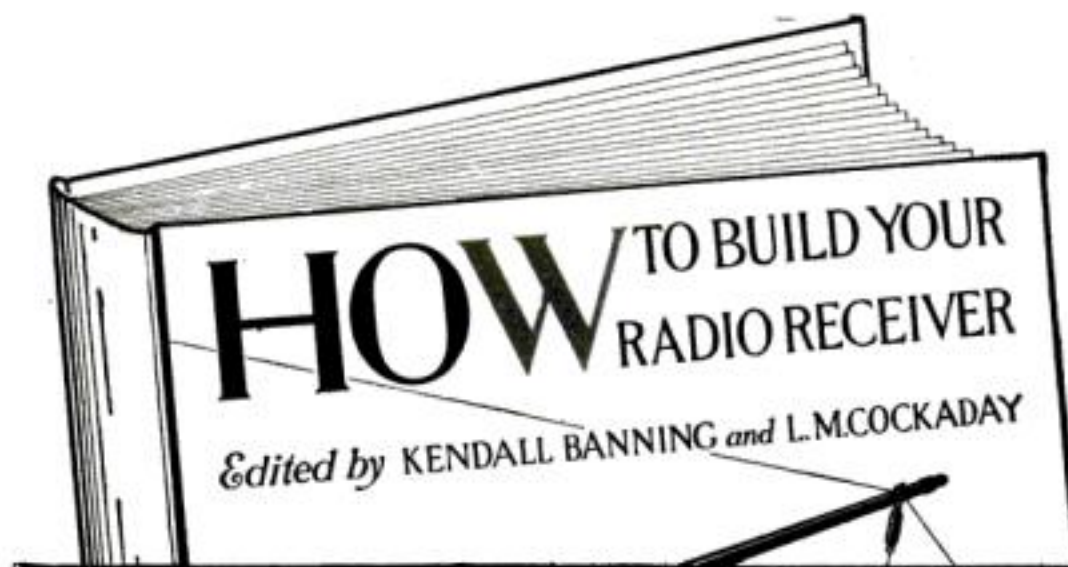
DEAR SIR: You may send me entirely free and fully prepaid, a copy of your book, "How to Become an Electrical Expert," and particulars about your Home Study Course in Electricity.

Name

Address

City State

The Cooke trained man is the "Big Pay" man



96 Page **FREE** Handbook

Edited by Kendall Banning
and

L. M. Cockaday

Popular Radio's New Book

"How To Build Your Radio Receiver"

POPULAR RADIO'S new 96-page handbook, edited by Kendall Banning and Laurence M. Cockaday, is now ready for delivery. For a limited time only, as an introductory offer, it will be *given away free!*

There has long been a need for such a book as this, describing fully and completely the several different types of radio receiving sets which have proved most effective, and *how to build them.*

Popular Radio's new book, "How to Build Your Radio Receiver," has been carefully planned to fill this need. No pains have been spared to make this book the most comprehensive and valuable contribution of its kind ever published for the radio enthusiast who, *with or without previous technical knowledge or training,* wishes to construct a radio receiving set of his own that will meet his every requirement.

"How to Build Your Radio Receiver" gives complete specifications for the construction of *seven* separate and distinct receiving sets—covering the most amazing range and variety of circuits, from the most modern simple crystal set to the famous Superheterodyne.

All working details are given—the lists of parts required and their

approximate cost; complete hook-ups and circuit diagrams and *how to read them;* illustrations making all points clear, and simple instructions on how to assemble, mount, wire and operate each set.

Nor have any helpful pointers been omitted. In this new book, edited by Mr. Banning and Mr. Cockaday, you will also find scores of valuable hints and suggestions about aërials, how to select your parts, how to install your set, tips on tuning, and how to learn the code.

In all, a book you will not want to be without—one that will be worth many dollars to you. Yet, if you act at once, it will not cost you a penny. We will send you a copy of this valuable handbook absolutely free with a year's subscription to POPULAR RADIO, the leading magazine in the radio field, edited by Kendall Banning and L. M. Cockaday. If you are already a subscriber, you may renew or extend your subscription for an additional year and still secure one of the first copies of this valuable book *absolutely free.*

The Coupon printed at the bottom of this page provides a convenient means for you to secure one of the first copies of this handbook free. *But you must act at once!*

A \$5 Crystal Set

The simplest up-to-date set for local broadcast reception. Approximate range 15 miles. Clear signals on headset without distortion. No operating cost.

The Haynes Single Tube Receiver

May be made at an approximate cost of only \$15 for parts. Simple to tune, selective, good audibility. Long distance range up to 1,000 miles on ear-phones.

A Two-Stage Audio-Frequency Amplifier

May be added to any set, crystal or tube, to strengthen the received signals so they will operate a loud speaker. Easy to construct, efficient, and costs only about \$15 for parts.

The Cockaday 4-Circuit Tuner

A 3-tube set, famous for its high selectivity and beautiful tone. Cost of parts about \$40. Receiving range approximately 1,500 miles on a loud speaker.

A 5-Tube Tuned Radio Frequency Receiver

The possibility of "oscillation and re-radiation" is eliminated. May be built at a cost of only \$90 for parts. Range about 1,000 miles on loop or indoor antenna, and 2,500 to 3,000 miles on outdoor antenna.

7 Remarkable Receivers

Illustrated Diagramed Described

EACH of the sets described in POPULAR RADIO'S new handbook has been selected as the most *ideal* of its kind—for distance, selectivity, tone, volume, simplicity of construction, ease in tuning, reliability and general all-around satisfaction.

You will find sets employing both crystal and vacuum tube detection, with regenerative amplification, audio-frequency amplification, "push and pull" power amplification, radio-frequency, *compensated* radio-frequency and *intermediate wave* radio-frequency amplification.

You have your choice of crystal, one-tube, three-tube, five-tube, six-tube or eight-tube sets—the broadest selection anyone could ask for, all clearly illustrated, charted and explained in the simplest possible terms.

FREE

As a special introductory offer, for a limited time only, this book will be given FREE with a year's subscription to POPULAR RADIO at \$3. Simply mail your remittance with the handy coupon below, and a FREE copy of "How to Build Your Radio Receiver" will be sent you, postage prepaid. Your subscription will be entered at once.

The "Improved" Cockaday 4-Circuit Tuner

Probably the most important contribution yet made to the equipment of the radio fan. A compact 5-tube set with a receiving range of over 3,000 miles. Cost of parts about \$95. Automatic tuning and power amplification. Maximum volume of sound, excellent reproduction and no interference.

The Regenerative Superheterodyne Receiver

More sensitive, more selective and more simple to tune than any other 6-tube receiver yet developed. Cost of parts approximate \$100. Range of 3,000 to 4,000 miles on a loud speaker. Has been called the "Rolls-Royce" of radio receivers.

—Also innumerable practical suggestions and complete list of U. S. and chief foreign Broadcasting Stations of 50 Watts power and up.

POPULAR RADIO, Dept. 132
9 East 40th Street, New York City

MAIL THIS COUPON NOW!

Please send me, postage prepaid, a FREE copy of POPULAR RADIO'S new handbook, "How to Build Your Radio Receiver," edited by Kendall Banning and L. M. Cockaday. I enclose \$3 for a year's subscription to POPULAR RADIO which entitles me to this book absolutely free.

NAME.....

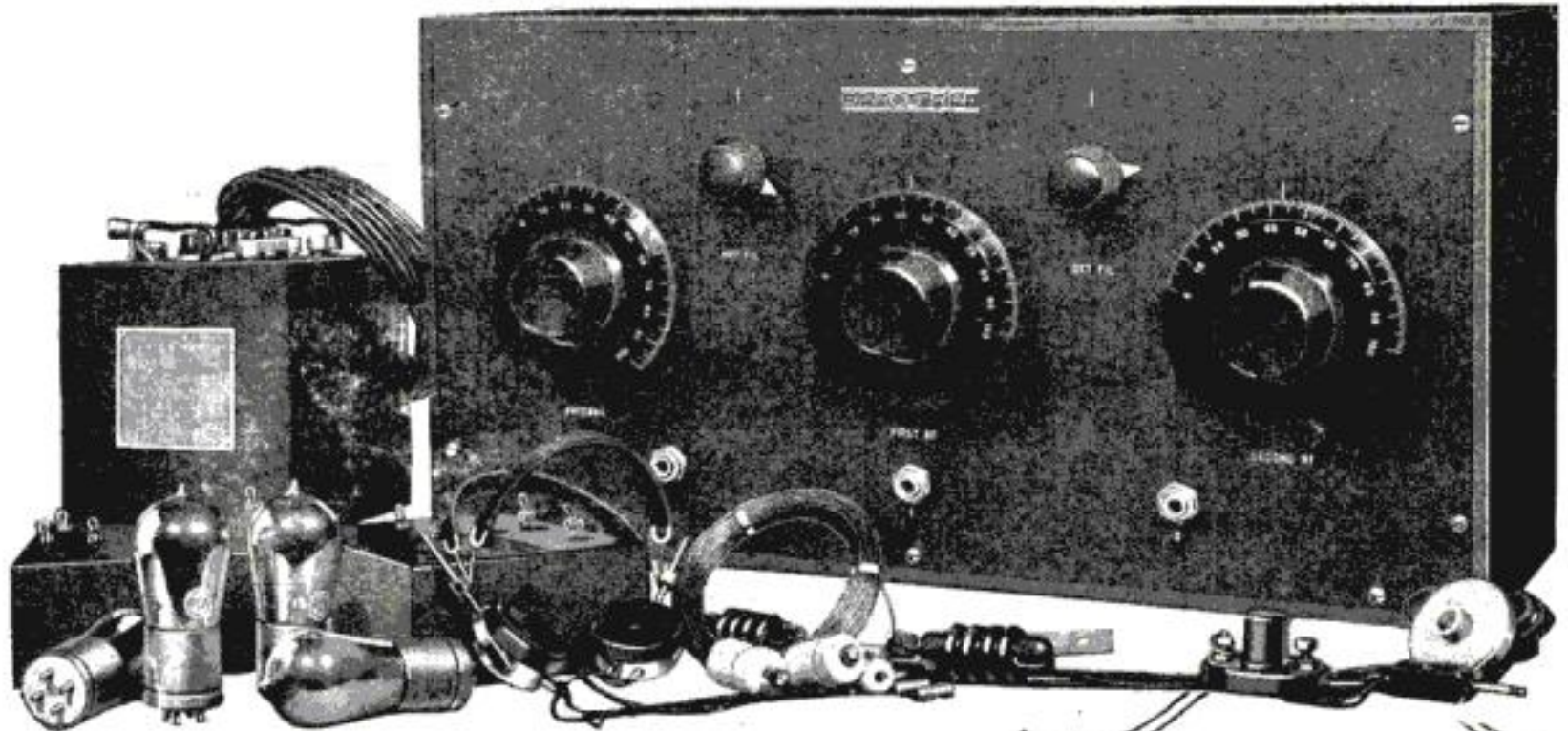
STREET AND NO.....

CITY AND STATE.....

(No extra for Canada. Foreign countries 50 cents postage extra)

Hazeltine Neutrodyne!

The wonder radio receiver that has taken the country by storm—that people are standing in line to buy, will be sent to you on this great special offer.
Set "Factory Built" by the Garod Corporation, Newark, N. J., under Hazeltine Patents



Complete Outfit —
\$20⁰⁰
Down

Brings it to you Complete and Ready-to-Use—Balance in Easy Monthly Payments

HERE, AT LAST, is a Radio Receiver that is performing new miracles—things never before thought possible. And on our limited offer you enjoy its wonders for only a small payment down—remainder in easy monthly payments. Write for the offer we are making. Mail coupon.

In Chicago, New York and other big cities, people stand in line to get a chance at the limited supply of these sets that come into the big stores. They wait—they beg for them. They even pay premiums over list prices—anything to get a Neutrodyne.

And why not? Was anything so wonderful ever dreamed of before Mr. Hazeltine developed this Radio Marvel? No! Before you can even understand the marvelous accomplishments of the Neutrodyne, you must revise all your old ideas of

Write Today for our special easy payment offer on this complete "Factory Built" Neutrodyne outfit. Do not delay. Our present supply is very limited. This announcement will create a demand far greater than we can supply. Remember, you may have your Radio set NOW and enjoy it while paying. Mail coupon now.

Babson Bros., 2843 West 19th Street
Dept. 13-63, Chicago, Ill.

All these accessories included:

- 4 Vacuum Tubes.
- 6 volt—Storage Battery.
- 2—45 volt "B" batteries
- 1 pair of head phones with plug
- 1 Nathaniel Baldwin special phonograph loud speaker unit.
- Aerial, wiring equipment, insulators, lightning arrester, etc.

This outfit includes either the Baldwin Loud Speaker Phonograph Unit as listed above, or at a small additional cost you can have the Nathaniel Baldwin Loud Speaker Horn.

Nothing more to buy!

radio values. For instance, that expression "selectivity" — it used to mean one thing, but Neutrodyne has given it an entirely new meaning. Forget all past conceptions—try this Neutrodyne and you will see how you can tune out powerful local stations and bring in distant programs.

Every Neutrodyne factory is working to capacity. Their product is going mostly into the big cities and even then there is not enough to fill more than a small part of the demand. But Babson Bros.' purchasing power has secured some sets for their friends and customers in other places.

We now offer one to you. We do not ask a premium. We sell you the set at list price. We even save you some money on your accessories. And on top of all this we sell you this complete outfit on easy installment payments — and with a money back guarantee. We make it possible for those who act quickly to own a Neutrodyne—and the finest Neutrodyne ever built. And on a remarkable easy payment offer. Write!

Babson Bros., 2843 West 19th St., Dept. 13-63, Chicago, Ill.
Please send me your special offer on a complete Neutrodyne outfit on Easy Monthly Payments.

Name

Address



Money Making Opportunities for "Popular Science" Readers

AUTOMOBILES AND ACCESSORIES

PATENTS—Write for our Guide Books, List of Patent Buyers and "Records of Invention Blank" before disclosing inventions. Send model or sketch of your invention for our free opinion of its patentable nature. Terms reasonable. Victor J. Evans & Co., 189 Ninth, Washington, D. C.

AUTOMOBILE parts—Used parts for most any car at half factory list prices. Allen, Briscoe, Buick, Cadillac, Chalmers, Chevrolet, Dodge, Ford, Grant, Hudson, Hupmobile, Oakland, Overland, Oldsmobile, Reo, Studebaker and many others. Send list of parts wanted. Maxwell Bros., 4106 Olive Street, St. Louis, Missouri.

AUTOMOBILE owners, garagemen, mechanics, send for free copy America's popular motor magazine. Contains helpful, money-saving articles on repairing, overhauling, ignition, carburetors, batteries, etc. Automobile Digest, 523 Butler Bldg., Cincinnati.

M. P. LAUGHLIN—Patents-Engineer-Attorney-Specializing Power-Automotive Inventions. 48 East 41st St., New York.

FORD ACCESSORIES

SPEEDSTER fans—see "Red-i-Kut" ad, page 154.

MOTORCYCLES, BICYCLES, SUPPLIES

DON'T buy a bicycle motor attachment until you get our catalogue and prices. Shaw Mfg. Co., Dept. 4, Galesburg, Kansas.

DON'T pay \$50 for bicycles, buy motor cycles \$50 to \$100. Easy terms. Pay as you ride. Non skid Ford tires \$5, tubes \$1.25. Bicycles, motor cycles at factory prices; talking machines at half price. Records 20c. Send 10c in stamps for catalogues. Deninger Price Cutter, Rochester, New York.

OVERSTOCKED—200 Used Motorcycles. Must be sold at once. We have Harley-Davidsons, Indians, Hendersons, Excelsiors, Clevelanders. Prices \$25.00 up. Write for our Bargain List. Myerow Brothers, Dept. C, 15, Berkeley St., Boston, Mass.

MODELS AND MODEL SUPPLIES

WE make working models for inventors and experimental work, and carry a complete stock of brass gears and model supplies. Send for catalogue. The Pierre Model Works, Tinley Park, Illinois.

MODEL making and experimental work; modern shop, expert workmen. Manufacturing. Lamson El. & Mfg. Co., 625 W. Jackson, Chicago.

MODELS and Tools made to order. Estimates. Schmidt, 394 Canal St., N. Y.

WE Build Models, design, develop, and manufacture articles in large or small quantities. Homeyer Machine Products and Mfg. Co., 1385 E. 17th St., Cleveland, Ohio.

MODEL steam engines, boilers, boats, model ship and naval fittings, model makers' supplies. Send 20c for new and enlarged illustrated catalogue and handbook. Bathe Mfg. Co., Dept. C, 5214 Woodland Avenue, Philadelphia, Pennsylvania.

MOTORS, ENGINES, MACHINERY

MOTORS—G. E., 1/4 H.P., \$15.00; 1/2 H.P., \$32.50, 1 H.P., \$62.50. Generators, 8 volt, 10 amp., \$15.00; 32 volt, 500 watt, \$30.00. Other sizes, low prices. Motor Specialties Co., Crafton, Pennsylvania.

STEPTOE'S medium priced line of Shapers, Milling Machines, Lathes, and Die Slotters will reduce your manufacturing costs. Established since 1845. Catalog upon request. The John Steptoe Company, Camp Washington, Cincinnati, Ohio.

SHOP EQUIPMENT

CIRCULAR Saw for bench. Write Box 17, Hackettstown, New Jersey.

AVIATION

THE American School of Aviation announces a new correspondence course in mechanics of aviation. A thorough training in practical aeronautics. American School of Aviation, Dept. 1743, 3601 Michigan Ave., Chicago, Illinois.

PROPELLERS for aeroplane propulsion, 5-foot diameters, \$12; 6-foot for Fords, \$15; others in proportion. Motorcycle sleigh blueprints, 75c; Ford Size, \$1.00. Pictures free. Crawford Motor and Aeroplane, Long Beach, California.

AMERICAN MADE TOYS

MANUFACTURERS on large scale, also homeworers wanted to manufacture metal toys and novelties. Millions needed of barking dogs, wag tail pups, wild animals, automobiles, Indians, cowboys, baseball players, cannons, toy soldiers, crowing roosters, Statues of Liberty, miniature castings of capital, bathing girl souvenirs and others. Unlimited possibilities. Guaranteed casting forms furnished manufacturers at cost price from \$5.00 up, with complete outfit. No experience or tools necessary. Thousands made complete per hour. We buy goods all year and pay high price for finished goods. Cash on delivery. Contract orders placed with manufacturers. Catalog and information free. Correspondence invited only if you mean business. Metal Cast Products Co., 1696 Boston Road, New York.

Another \$25.00 IN PRIZES

To win one of these cash prizes is easy, and every reader is invited to enter this fascinating competition. Just write a letter of not over seventy words answering this question:—

What advertisement of "Money Making Opportunities" in this issue interests you most and why?

Here are the prizes we will pay for the ten best letters answering the above question:—

First Prize \$10.00
Second Prize 5.00
Third Prize 3.00
And 7 Prizes
of \$1.00 each 7.00

First read every one of the "Money Making Opportunity" advertisements on pages 8 to 26. Check the ones that interest you. Then read over the ones you have checked and decide on the one that interests you most.

Then write a short letter, *not more than seventy words*, telling us why the advertisement you pick interests you most. Remember that ten prizes will be awarded. You have a good chance of winning one of them. Be sure to mail us your answer before March 1st. The prizes will be awarded, in the order of their merit, for the letters that are most interesting and best expressed.

The names of all the prize winners and the letters that win the first two prizes will be printed in this column in the May issue. Address your prize letter to

Contest Editor

POPULAR SCIENCE MONTHLY
225 West 39th Street, New York City

Last Month's Prize Winners

The First Prize of \$10.00 goes to Mr. T. Metcalfe, 129 S. Ardmore Ave., Los Angeles, Cal., for his letter on the advertisement of the Metal Cast Products Company. Here is Mr. Metcalfe's letter:

Dear Sir:—

The Metal Cast Products Company evidently realizes that brevity, though it may be the soul of wit, is not the secret of successful Classified Advertising. Its "opportunity announcement," by its very size, attracted my attention, and having obtained that, proceeded to tell me clearly, without confusing abbreviations, just what the company had to offer. The proposition interested me to the extent that I immediately sent off a reply.

TOM METCALFE.

Mr. James E. Noble, of Toronto, Ont., Canada, wins the second prize for his letter on the advertisement of E. Palmer.

Contest Editor:—

I was attracted by E. Palmer's ad as it appears in the January issue. It offers at once what most ad readers desire, a business of their own, especially, if like myself, they are semi-invalids. I desire to tender my sincere thanks to Popular Science for directing my attention to this opportunity. I am more than satisfied with the value I received for the money I invested with your advertiser.

JAMES E. NOBLE.

The Third Prize goes to C. N. Cropper, Marysville, Utah.

The Winners of the other seven prizes are:

Bonner Mills, Greenville, S. C.; E. G. Holland, Birmingham, Ala.; E. M. Hoefel, St. Louis, Mo.; Ivar Thuresson, Naugatuck, Conn.; Raymond R. Rosenblatt, Detroit, Mich.; J. M. Freeman, West Hickory, N. C.; Edmund H. Brown, New York, N. Y.

Rate 25 Cents a Word. Advertisements intended for the May issue should be received by March 5th

RADIO AND SUPPLIES

YOU don't need tubes to get out of town. If you want new stations on your crystal set, write me today. Mine works 400 to 1,000 miles without tubes or batteries! Thousands have bought my plans and now get results like mine. Changes often cost less than dollar. Send self-addressed envelope for further information. Leon Lambert, 555A So. Volusia St., Wichita, Kansas.

RADIO generators 500 V 100 Watt \$28.50 each. Battery chargers \$12.40—High speed motors. Motor-Generator sets, all sizes. Motor Specialties Co., Crafton, Pennsylvania.

RADIO Book, 25c. Agents wanted. Hadley, 46 Rosedale St., Bridgeport, Conn.

LOUD Speaking Crystal Set. Broadcastings heard throughout house. Easily constructed. Instructions complete 25c. Catalog free. Steinmetz Wireless Mfg. Co., 5810 Penn Ave., Pittsburgh, Pa.

BLUR Generators, brand new, 6 volts, maximum output 22 amperes at 2000 r. p. m. Government paid \$45.00 each, our price \$10.00. General Sales Company, 1921 S. Michigan Avenue, Chicago, Ill.

ARMSTRONG Regenerative Receivers (Licensee!) 500 to 1000 miles distance, complete with tube, phones, batteries, aerial, \$26.75. Cash with order. William Gibbons, 535 Palace Building, Minneapolis, Minn.

ADVERTISING

ADVERTISE in 24 metropolitan dailies, 24 words, \$15.00. Helpful Guide listing 1000 publications, 4c stamps. Wade Company, Baltimore Bldg., Chicago.

ADVERTISING rates for magazines and weeklies free. Charles A. Lutz, Apartment 241, York, Pennsylvania.

151 RURAL weeklies, \$6.04. Ad. Meyer, 4112 P. S., Hartford, St. Louis.

ADVERTISERS: Your 35 word ad in 51 magazines \$2.00. Free Advertising Booklet. Auto-City Agency, 2747 Gladstone, Detroit.

ADVERTISING NOVELTIES

GILT lettered Advertising-Pencils for you. Buy direct; save entire middleman's profit. Samples free (no agents). Address S. Musial & Co., 10-14 Lincoln St., Yonkers, N. Y.

DUPLICATING DEVICES

"MODERN" Duplicators save Time, Labor and Money. Gets business. Reproduces Typewritten or Panned Letters, Drawings, Lessons, Music, Menus, Bids, Notices, Specifications, Maps or anything in one or more colors. Prints two per minute. Special sale on. 30 days' free trial, \$2.25 up. Booklet free. J. V. Durkin-Reeves Co., Pittsburgh, Pennsylvania.

STENCIL Duplicators—Note, \$3.00; Letter, \$4.00; Hand Use. Typewriting—Handwriting. On Approval. Primos Specialty Co., 3-X, Primos, Pa.

TYPEWRITERS AND SUPPLIES

TYPEWRITERS all makes. Save one-half. Thoroughly rebuilt in our factory by the famous "Young Process." Fully guaranteed. Free trial. We handle all standard makes. Cash or sold on easy terms. Write for Catalog. Young Typewriter Co., Dept. 5043, Chicago, Ill.

ALL makes, rebuilt, refinished and guaranteed ten years. \$15.00 up shipped privilege 30 days' time. Get our prices and agents proposition. Typewriter Manufacturers Exchange, Fordham, New York.

TYPEWRITERS sold on payments. Free trial. Payne Company, Dept. 220, Rosedale, Kansas.

LABORATORY AND CHEMICAL

EXPERIMENTERS. Complete supplies for the chemical laboratory. Catalogue 5c. National Scientific Supply Co., 241 Pennsylvania Avenue, Washington, D. C.

YOUR chemical problem solved and working process furnished for five dollars. When your process or formula is furnished by me 25 years of experience is back of it. This means expert service and satisfactory results. Write me. W. Stedman Richards, Consulting Chemist, Box 2402, Boston, Mass.

SEE radium rays using our \$1.00 Spintharoscope. Laboratory apparatus, chemicals. Send for bargain prices. Washington Scientific Co., 2109 Fourteenth Street, Washington, D. C.

CHEMICAL Service. Formulas, analysis, methods, experiments. Jacob Stuyter, Chemist, 2527 East St., Davenport, Iowa.

PRODUCTS: formulas; duplicated, improved, cheapened. Ethical. H. Ing. Box 1029, Chicago.

TRADE SCHOOLS

PAINT Automobiles. Trim Automobiles. Become a Certified Electrician. Auto Battery Builder. Ignition Expert on Starting and Lighting. Metal Finisher, and a complete course in Auto-Repairing, Bricklaying and Plastering. We fit you for a big money job. Make you an expert able to step right into a position paying \$45 to \$100 per week. You are paid while learning. We maintain our own dormitories. Come to Detroit, the Automobile hub; the World's wonder city. Write today. Standard Trades School, 416 Woodward, Detroit, Mich.

**More Money Making Opportunities
on pages 10 to 26**

Your Social Secretary for Life



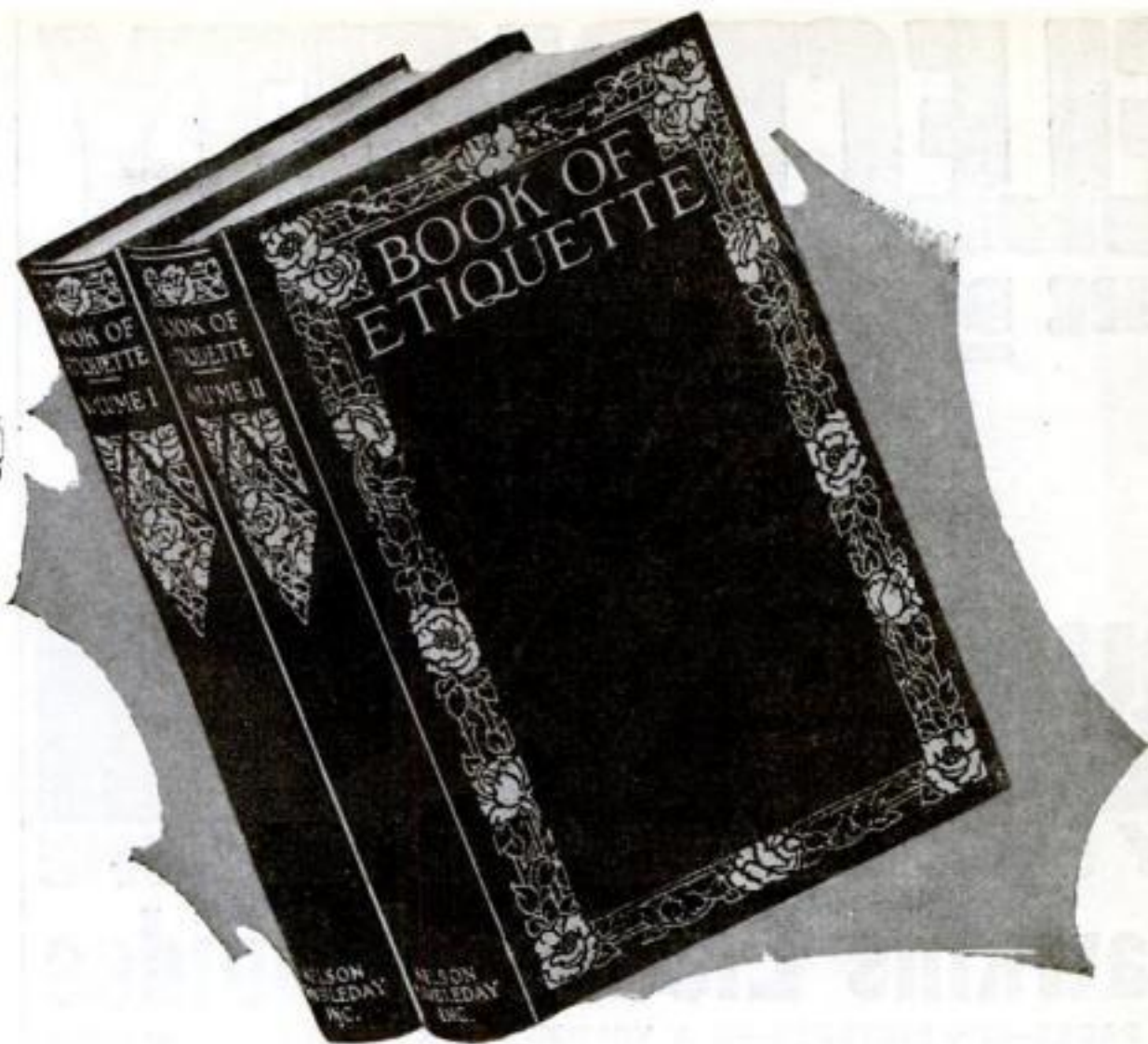
They are selecting a ring to seal their engagement, but both are in a lull. Should he have chosen it by himself, without consulting her individual preferences? The Book of Etiquette would have told them what they wish to know. Throughout life this famous book acts as a guide, a silent "social secretary."



"Perhaps you know how embarrassing it is to be introduced to strangers at a dance or other formal functions when you don't know what to say or do. One of the greatest values of the Book of Etiquette is that it shows you how to be perfectly poised and self-confident on every occasion."



Do you know when and how to tip—and the correct amounts? The Book of Etiquette can tell you exactly what is correct—just as it gives you other valuable information of all kinds. Be sure to grasp the rare opportunity on this page.



Save \$1.50 on the Famous Book of Etiquette Nearly Half a Million Sold for \$3.50 Special Short Time Offer **Only \$1.98**

YOU'VE always wanted the famous two-volume set of books that solves every social difficulty, that tells you exactly what to do, say, write, and wear on every occasion. You have always wanted to own the two remarkable books that give poise, ease, dignity, self-confidence.

Here is your opportunity to secure the complete original, authentic BOOK OF ETIQUETTE for almost half-price. Almost 500,000 people have purchased the BOOK OF ETIQUETTE for \$3.50. If you act at once, you can get it for only \$1.98.

Solves Every Social Problem

The BOOK OF ETIQUETTE is admittedly one of the most complete and authoritative works of its kind ever published. It covers every phase of wedding etiquette, street etiquette, dinner etiquette, dance etiquette—it contains paragraphs for the self-conscious and timid; for the bachelor; for the business woman; for the country hostess. Nothing is forgotten, nothing omitted. The BOOK OF ETIQUETTE will tell you everything you want to know. It will protect you from sudden embarrassments, give you a wonderful new ease and poise of manner.

Send No Money—The Coupon Brings It To You

This is your chance to take advantage of a tremendous bargain. Half a million people have paid \$3.50 for the Book of Etiquette. Here's your chance to secure the

same Book of Etiquette for only \$1.98.

We know you won't overlook this unusual chance. Mail the coupon to-day and the Book of Etiquette will be sent to you in a plain carton. No money is necessary. But be sure you get the coupon off at once. Nelson Doubleday, Inc., Dept. 253, Garden City, New York.

USE THIS SPECIAL COUPON

NELSON DOUBLEDAY, INC., Dept. 253
Garden City, New York

I am glad you have made this low-priced special offer. By all means send me the Book of Etiquette (complete in two library volumes), for which I will give the postman only \$1.98 (plus delivery charges). Instead of the regular price of \$3.50. It is understood that I have the privilege of returning the books any time within 5 days if I am not delighted with them, and you agree to refund my money.

Name.....
Address.....

☐ Check this square if you want these books with the beautiful full-leather binding at \$2.98 with same return privilege.
(Orders from outside the U. S. are payable \$2.44 cash with order. Leather binding, outside U. S., \$3.44 cash with order.)

ELECTRICITY

THE BIG PAY TRADE

QUICKLY
LEARNED

BY EASY SPARE-TIME READING

Hawkins Electrical Guides

3500 PAGES—4700 PICTURES—\$1 A VOLUME—\$1 A MONTH—10 VOLUMES

Know the facts in Electricity. They mean more money and better position for you. Hawkins Guides tell you all you need to know about Electricity. Every important electrical subject covered so you can understand it. Easy to study and apply. A complete, practical working course, in 10 volumes. Books are pocket size; flexible covers. Order a set today to look over.



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Easy to Read
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LEARN ALL ABOUT THESE IMPORTANT POINTS

Magnetism—Induction—Experiments—Dynamometers—Electric Machinery—Motors—Armatures—Armature Windings—Installing of Dynamos—Electric Instrument Testing—Practical Management of Dynamos and Motors—Distribution Systems—Wiring—Wiring Diagrams—Sign Flashers—Storage Batteries—Principles of Alternating Currents and Alternators

—Alternating Current Motors—Transformers—Converters—Rectifiers—Alternating Current Systems—Circuit Breakers—Measuring Instruments—Switchboards—Wiring—Power Stations—Installing—Telephone—Telegraph—Wireless—Bells—Lighting—Railways. Also many Modern Practical Applications of Electricity and Ready Reference Index of the ten numbers.

Over 5000
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NOW→

SHIPPED FREE NOTHING TO PAY
TO THE POSTMAN

Not a cent to pay until you see the books. No obligation to buy unless you are satisfied. Send Coupon now—today—and get this great help library and see if it is not worth \$100.00 to you—you pay \$1.00 a month for ten months or return it.

THEO. AUDEL & CO., 72 Fifth Ave., New York City

Please submit me for free examination, HAWKINS ELECTRICAL GUIDE (Price \$1 a number). Ship at once prepaid, the 10 numbers. If satisfactory, I agree to send you \$1 within seven days and to further mail you \$1.00 each month until paid.

Name.....
Occupation.....
Employed by.....
Home Address.....
Reference.....

P. S. M.—3 '24

Money Making Opportunities

FORMULAS

FORMULA catalog free. C. A. Lutz, Apartment 241, York, Pennsylvania.

3000 FORMULAS—400 pages—\$1.00 postpaid. Hillside Laboratories, 14802-D-Cooper, Harvey, Illinois.

ALL-penetrating liniment, positively gets the aches and pains of all kinds, rheumatism, etc. Formula, \$1.00. Ace Laboratory, 3421 Wabash, Chicago.

TATTOOS removed, formula \$1.00. Artist's guide teaching tattooing, \$3.00. Catalogue free. Arttattooist, 1050 Randolph, Detroit.

FORMULAS—Guaranteed. Catalog free. Bestovall Laboratories, 4047-P.J., North Whipple, Chicago.

"YOU MAN'S GUIDE" contains best 5,000 recipes and recipes for every trade, business, occupation, wife. Let this book make you money. Money-back guarantee. Paper cover \$1.25. Cloth \$2.00. Post-paid. Circular, book catalog free. Wells and Edwards, Department M, 852 George, Chicago.

FORMULAS: Chemical processes, household recipes, beverages, magic. Universal Laboratories, Newark, Delaware.

MANUFACTURING

LET us make your wood toys, patterns, castings, or stampings, send specifications for our prices. Alvatub Manufacturing Co., Batavia, New York.

DEVELOPING ideas and manufacturing our specialty. Absolute satisfaction. 33 years' experience; write us. The Eagle Way & Stop Signal Co., 2016 Elm St., Cincinnati, Ohio. Dept. C.

METAL-CRAFT manufactures dies, stampings, die-casting, screw-machine, and wire products reasonable. Plating, Enameling, Burnishing. Prompt, efficient service on any size contract. Modern equipped plant. A dependable source of supply. Metal-Craft Manufacturing Co., Box 259, Chicago.

DIES, Tools and General Manufacturing. Models and Manufacturing of new inventions our specialty. Logan Machine Co., 223 S. Clinton St., Chicago, Ill.

PRINTING, ENGRAVING, MULTIGRAPHING

BETTER Printing for Less Money. Write us about your printing needs, and you will save money. Ernest Fautus Company, 525 South Dearborn Street, Chicago.

EMBOSSED business, personal stationery. Samples, stamp. Daniels P. Company, Pittston, Pennsylvania.

225 BOND letterheads, envelopes, billheads, cards, \$1.25 each. Combination, \$4. Economic Printery, Leona, New Jersey.

EVERYTHING printed. Samples free. Franklin Press, B-34, Milford, New Hampshire.

500 TWO Color Letterheads, \$2.75. Samples free. Superior, 1825 Roosevelt, Indianapolis.

LETTERHEADS and Envelopes, \$2.00 per 500. Samples. Roney's Printery, Paris, Missouri.

1,000 LETTERHEADS or envelopes, \$3.00. Sent prepaid. Samples free. Monitor Press, Stockham Bldg., Morrisville, Pennsylvania.

500 EACH Hammermill bond letterheads, envelopes, \$4.50. Multigraphed letters \$4.25 thousand, delivered. H. T. Anderson, Box 897, Rockymount, N. C.

LETTERHEADS—Hammermill Bond 8 1/2 x 11, 500 \$2.65 cash. Other printing. MacDonald Printery, Marietta, Ohio.

1,000 HAMMERMILL letterheads, envelopes, \$3.25; 250, \$1.25. Samples Free. Troib Press, 98-A, Providence, Worcester, Mass.

CARDPRESS (Automatic), Equipment, Stock, \$115. Autopress, 678 Bloomfield, Montclair, N. J.

GUMMED LABELS

NAME and address, 500, 30c. Others, in rolls or loose. Stationery, 200 sheets and 100 envelopes printed \$1.00. Eastern Label Co., Clintonville, Conn.

WANTED

DETECTIVES—Excellent opportunity. Fascinating work. Experience unnecessary. Particulars free. Write American Detective System, 1968 Broadway, New York.

TYPISTS—Earn \$25-\$100 weekly in spare time copying authors' manuscripts. Write R. J. Carnes, P-1, Tallapoosa, Georgia, for particulars.

OLD gold, silver and platinum for cash. Penn Laboratories, 222 Market St., Newark, N. J.

ADDING MACHINES

ADDING and calculating machines. All makes. Free trial. Year's guarantee. Shattuck, 424 Fourth Ave., Pittsburgh, Pennsylvania.

WANTED—TO BUY

CASH for old gold, silver, platinum, watches, diamonds, magneto points, gold crowns, false teeth, and other valuables. Merchandise returned if offer unsatisfactory. Busch Products, Dept. 55, 144 Fifth Ave., New York.

MAIL Old Gold, Silver, Platinum, Diamonds, Jewelry, Bonds, Thrift, Unused Postage Stamps, etc. Money wired within one hour for valuables, held ten days, returned if unsatisfactory. Ohio Smelting Co., 315 Hippodrome Bldg., Cleveland, Ohio.

INSECTS WANTED

WHY not spend Spring, Summer and Fall gathering butterflies, insects? I buy hundreds of kinds for collections. Some worth \$1 to \$7 each. Simple outdoor work with my instructions, pictures, price-list. Send 10 cents (not stamps) for my Illustrated Prospectus before sending butterflies. Mr. Sinclair, Dealer in Insects, Dept. 7, Ocean Park, California.

More Money Making Opportunities
on pages 8 to 26

A New and Mysterious Happiness

A Startling and Sensational Discovery

A Mysterious Secret

NO wonder men and women everywhere are excited over this startling discovery of a Universal Law and Power by which a new meaning is given to every pleasure, function, action and to every joy, gratification and happiness.

Who could resist becoming excited if the pleasurable realization of life in all of its phases were multiplied and intensified?

You, too, will become excited over this great discovery because it will give you a new thrill—an intense and lasting thrill.

This new and startling discovery of a supreme natural law of life, health and pleasure is joyfully revolutionizing the lives of thousands of men and women all over the world. It is bringing them a new kind of pleasure, happiness, health, strength, confidence, energy and power of personality and success. It is giving them such marvelous energy of mind and body, and they enjoy life so fully, so intensely, so dominantly, and so thoroughly that the old life to which they were accustomed appears totally inferior in every respect.

The possession of this new and mysterious natural law gives a new idea of how truly vital, alive, joyful, healthy and happy a human being can be—how easily one can be overflowing with life, energy, bubbling vitality and the fire of triumph. Although thoroughly natural and simple, nevertheless it accomplishes seemingly impossible results without sacrifice, active effort or cost.

A new life with a unique thrill is yours when you possess this newly discovered natural law of supreme life, health and pleasure. It is no longer necessary for one to spend money for treatments and drugs and dieting and books and systems and cures and pills and devices, because perfect and supreme health and life are absolutely free through this marvelous natural law.

Why be weak, why be ill, why be fat, why be thin, when you may, absolutely free, become in every way perfect and supreme through this sensational natural law?

This extraordinary natural law yields

amazing nerve force, amazing energy, amazing vitality and amazing power of every character of mind and body—a new and superior life.

Through this sensational natural law you may have all of the benefits of exercise without exercise; all of the benefits of conscious deep breathing without conscious deep breathing; the full and complete benefit of every vitamin and organic iron without drugs or dieting; all of the benefits of medicine and drugs without medicine and drugs; all of the benefits of auto-suggestion, hypnotism and psychology without auto-suggestion, hypnotism and psychology; all of the benefits of dieting, and every other kind of treatment, device or assistance without these treatments.

Through this amazing natural law, anyone can rid self permanently of every human weakness; no matter who you are, this Natural Law can demonstrate to you that you do not yet know the full meaning of joy, pleasure, happiness, vitality and gratification.

This Natural Law is ready to give you a new realization of the meaning of life and enjoyment.

This extraordinary and Universal Law does not require you to actively do anything or give up anything. It requires no exercise, no time, nor conscious deep breathing—no stretching, dieting, drugs nor medicines.

This natural and supreme law must not be confounded with hypnotism, autosuggestion, psychology, spiritual science, psychic science, mental science, nor with electricity or any other method—mental or physical—ever devised in the past.

No self-hypnotizing phrases to repeat—no yielding, no recession, no giving up of anything, nothing to study, nothing to actively practice, no books to buy, nothing to memorize, no self-deception—nothing but truth—reality—Natural Law. Perfect health cures every known and conceivable disease. This startling natural law is guaranteed to give perfect health.

If you are not enjoying life to the full—if you are in any way handicapped—if you are not in possession of all of the powers of mind and

body to the highest degree, you owe it to yourself to at once procure for yourself, free of charge, this revolutionary natural law.

Through this supreme natural law anyone may have the health and vitality of a lion or tiger.

Remember that the demonstration and results are immediate and free. This powerful natural law transforms the gloom of disease into the bloom of health, as the rays of the spring sun transform the dead soil into a "sea" of luxuriant vegetation. It is destined to revolutionize human health and happiness—Humanity.

This natural law is most marvelous, most simple, most subtle and most powerful. It is the Law of Creature Power.

Remember there is nothing active to do, nothing to study, nothing to believe, no time to waste, no habits to give up, nothing to lose—there is no mystery—it is merely Natural Law.

You would not be without this secret if you could imagine how delightfully transformed your life would be through the possession of this new and deeper realization of happiness, pleasure, joy and gratification.

This secret is offered to you absolutely free. There are no "conditions" or "strings" attached to this offer.

Special Note—Swoboda has a priceless secret for every human being who wishes to be happier, healthier, more vital and successful in a new degree.

ALOIS P. SWOBODA,
1231 Berkeley Building,
21 West 44th Street, New York City.

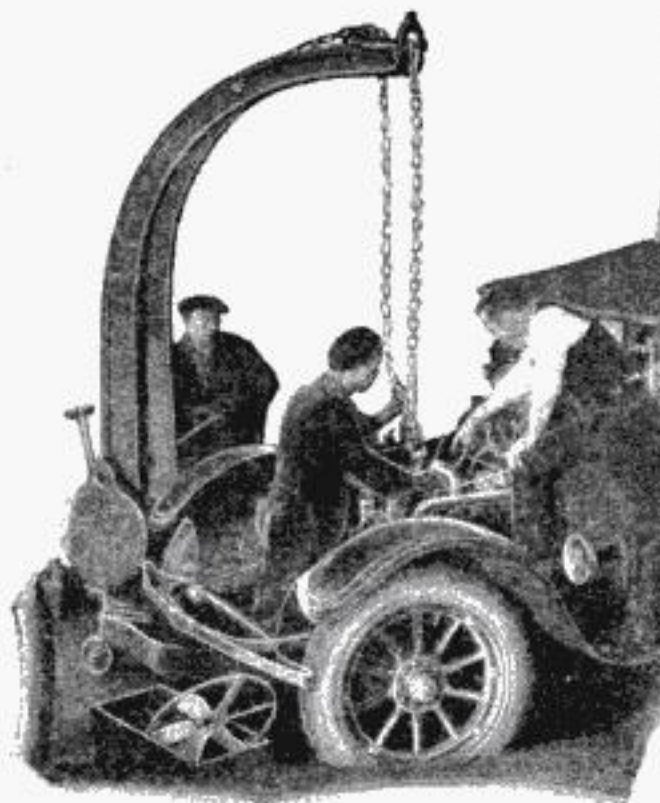
Send me FREE the Swoboda Natural Law of Supreme Life and Health.
To help cover the cost of publishing and mailing, I enclose postage. (Not more than ten cents, please.)

Name.....
(Write Plainly)

Address

City State

Special Note—Many individuals who have obtained this secret claim it is absolutely priceless—worth millions.



Be An **AUTO EXPERT**
Make \$75 to \$200
A WEEK

**Learn
at Home
to Boss
the Job**

B. W. COOKE
Directing Engineer
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**More Money Making Opportunities
on pages 8 to 26**



"I guarantee that the new method which penetrates to the starved root cells will produce a new, healthy growth of hair in 30 days or your money will be refunded. And furthermore, I want you as the user to be the sole judge. My special free book, now ready, explains the method in detail and tells you precisely why I am able to make this unusual free proof guarantee."

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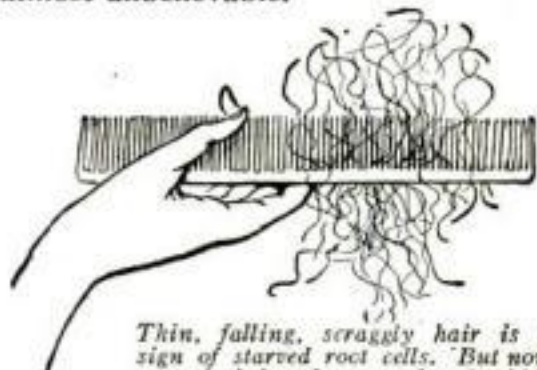
New Hair in 30 Days -or Costs You Nothing!

Alois Merke discovers a new, simple method guaranteed to grow thick, beautiful, luxuriant hair, or money instantly refunded. Gives new life and health to hair that is thin, falling, lifeless.

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To women this method is particularly interesting as it often transforms thin, falling hair into rich, luxuriant beauty in an unbelievably short time. It is unlike anything ever known in this country. It penetrates to the starved root cells, revitalizes and nourishes them—and the hair grows thick, lustrous, beautiful.

There is no massaging, no singeing, no unnecessary fuss or bother of any kind connected with this new method. It is simple, pleasant. Already hundreds of women who had thin, falling hair, hundreds of men who were "thin on top," have acquired new luxuriant growths of hair. Often the results are almost unbelievable.



Thin, falling, scraggly hair is a sign of starved root cells. But now a method has been perfected which penetrates to these cells and stimulates them into new activity.

Thin Falling Hair Given Glorious New Health

Is your hair thin, lifeless? Does it fall out, break? Is it dull and without lustre?

All these conditions are nature's signs of starved or atrophied hair roots. Ordinary methods cannot revitalize the roots, cannot reach them—no more than rubbing "growing fluid" on the bark of a tree can make the tree grow. You must get right at the roots and stimulate them. This remarkable new method provides, at last, an efficient way of invigorating the roots themselves. The hair becomes brighter, fluffier. New growths make their appearance within 30 days—if they don't there is no cost to you.

Some of the Amazing Results

The proof-guarantee is made possible only through splendid results that have already been achieved—as these few excerpts from letters testify. The letters are on file at the Merke Institutes and anyone may see them by coming to the office.

"I have been bothered with dandruff for 20 years and had lost nearly all of my hair. I have used your treatment 30 days now and have a good growth of hair coming in."

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Money Making Opportunities

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CREATE international friendships. Magazine, information 5c. Write: "Universalist," 1034A West Eighteenth St., Chicago, Illinois.

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More Money Making Opportunities
on pages 8 to 26

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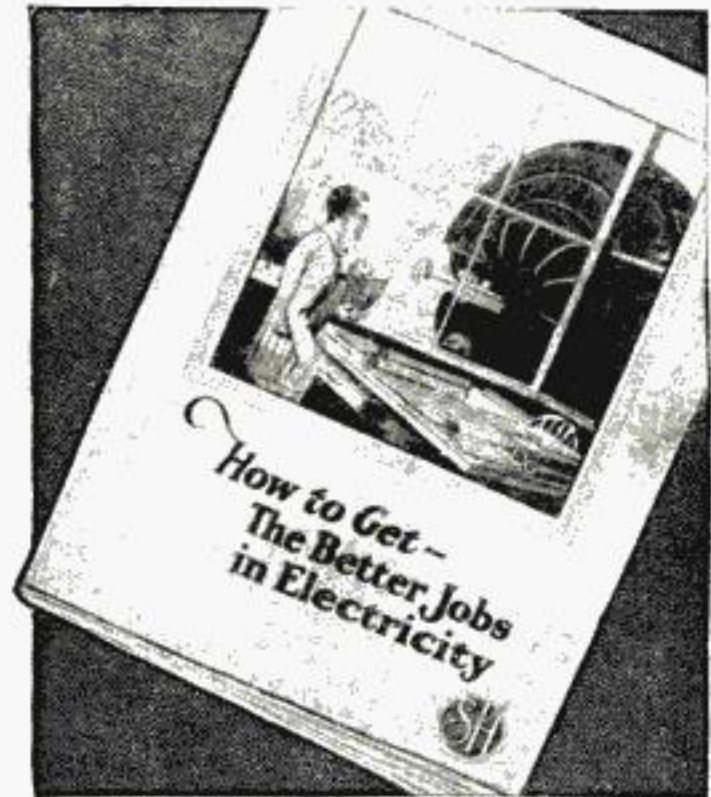
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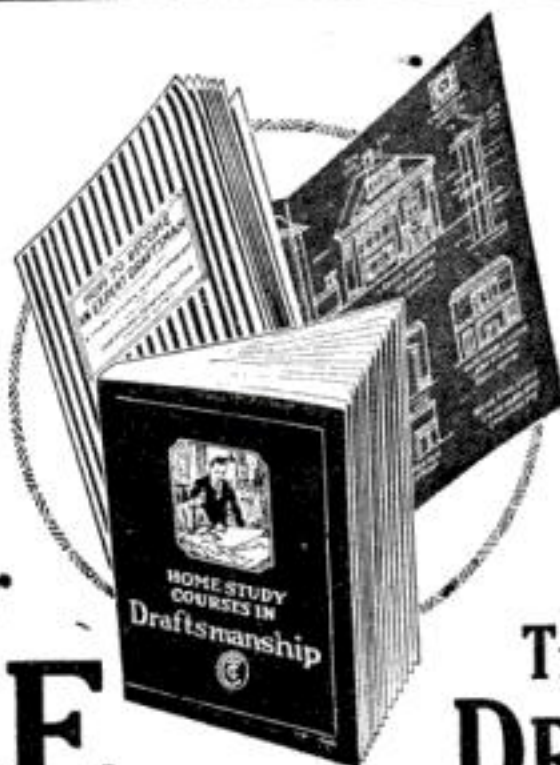
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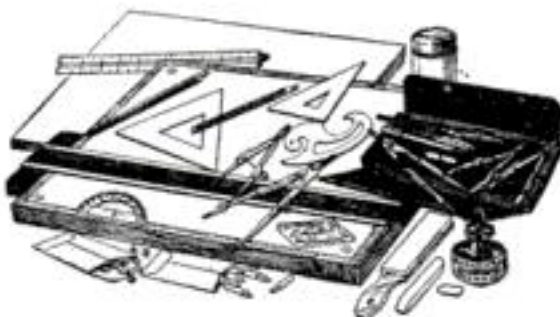
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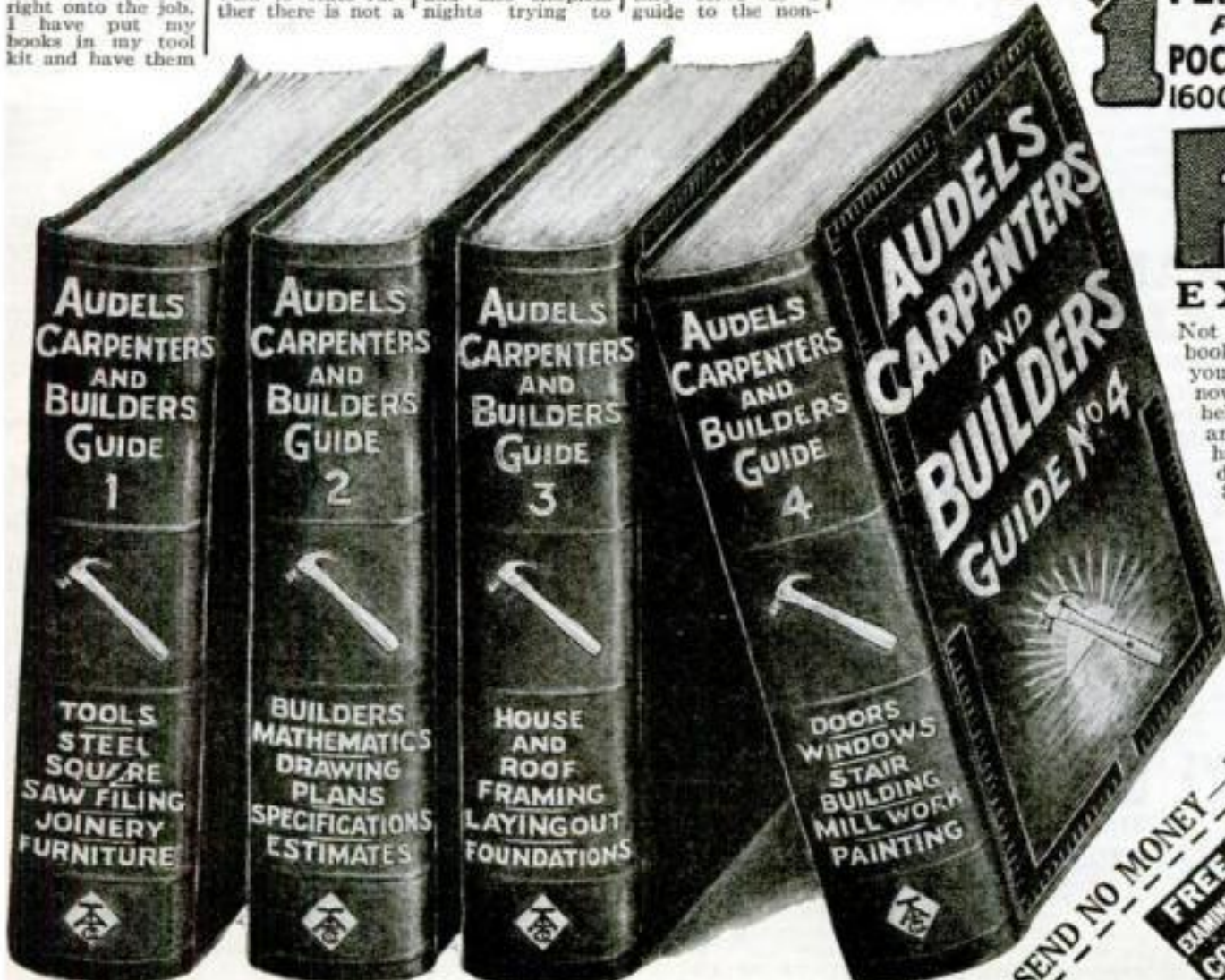
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AGENTS AND SALESMEN

AGENTS—Something New—fastest sellers and quickest repeaters on earth. Permanent, easy, profitable business. Good for \$50 to \$100 a week. American Products Co., 1801 American Bldg., Cincinnati, Ohio.

AGENTS—\$50 to \$80 a week. Build up a big, steady, profitable business. Take orders for our line of household specialties, food flavors, toilet preparations, etc. Easy to get orders. Known from coast to coast. Isbell, Penn., averaged \$6.00 profit per hour in spare time. Mrs. Mauk averages \$40 a week. Sell same customers month after month. Steady income. Write for sample and free Outfit offer. C. H. Stuart & Co., 5768 B'way, Newark, New York.

AGENTS—\$15 a day—Easy, quick sales—Free auto—Big weekly bonus—\$1.50 premium free to every customer. Simply show our beautiful 7-piece, solid aluminum handle cutlery set. Appeals instantly. We deliver and collect. Pay daily. New Era Mfg. Co., 803 Madison Street, Dept. 41-U, Chicago.

WONDERFUL Invention—Eliminates all needless for photographs. Saves time and annoyance. Preserves records. Lasts for years. 12,000,000 prospects. \$15.00 daily. Free sample to workers. Everplay, Desk 326, McClurg Bldg., Chicago.

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AGENTS AND SALESMEN WANTED

BIG Money in spare time for one man in each locality making embossed show cards and price tickets for stores and others. Easy, quick work. No training needed. New embossing machine does it all. 400% profit. Signs sell on sight. T. W. Cushing of Chicago sold \$76 first call, S. D. Downs averaged \$15 a day for 6 months. Many sell \$5 to \$20 daily. No speculation. Before you invest a penny we send you free sample cards to show merchants and convince yourself they sell at sight. Write today. Praemafix Corporation of America, Dept. 400, Geneva, New York.

AGENTS—Best seller: Jem Rubber Repair for tires and tubes; supersedes vulcanization at a saving of over 800 per cent; put it on cold, it vulcanizes itself in two minutes, and is guaranteed to last the life of the tire or tube; sells to every auto owner and accessory dealer. For particulars how to make big money and free sample, address Amazon Rubber Co., 504 Amazon Building, Philadelphia, Pennsylvania.

GET our plan for monogramming automobiles, trucks, hand luggage and all similar articles by transfer method; experience unnecessary; exceptional profits. Motorists' Accessories Company, Mansfield, Ohio.

\$10 DAILY silvering mirrors, plating and refinishing lamps, reflectors, autos, beds, chandeliers by new method. Outfits furnished. Write Gunmetal Co., Ave. F, Decatur, Illinois.

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BIG money and fast sales. Every owner buys gold initials for his auto. You charge \$1.50; make \$1.35. Ten orders daily easy. Write for particulars and free samples. American Monogram Co., Dept. 47, East Orange, New Jersey.

WANTED—Representatives in every factory in the United States. Popular Science Monthly, 225 West 39th Street, New York.

50% PROFIT selling name cards, penknives, stationery, catalog. Wolf Labels, Station E, Philadelphia.

AGENTS Wanted—Something New—Fire Fighter sells easily. Makes a spectacular demonstration; car owners, homes, factories, stores, practically buy on sight. Our men make \$10.00 to \$50.00 a day; exclusive territory. If you wish to establish a business of your own with unlimited possibilities for making big money, write us today. Fyr-Fyter Co., 191 Fyr-Fyter Bldg., Dayton, Ohio.

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GET our free sample case toilet articles, perfumes and specialties. Wonderfully profitable. La Derma Co., Dept. F, St. Louis, Missouri.

AGENTS: Big profits. Best and cheapest window letters made. Easily applied. Dime brings five samples. Particulars free. Stalbrit Company, 1115 Second Avenue, New York.

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AGENTS make 500% profit handling auto monograms, new pictures, window letters, transfer flags, novelty signs. Catalog free. Hinton Co., Dept. 126, Star City, Indiana.

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RUMMAGE Sales make \$50.00 daily. We start you. Representatives wanted everywhere. "Wholesale Distributors," Dept. 34, 609 Division Street, Chicago.

INSTANT Weld—Repairs largest punctures without cement or heat. Lenn's profit one day \$56. Write quick. Free sample. Territory going fast. Tourist's Pride Mfg. Co., Desk R, Minneapolis, Minnesota.

FREE Sample "Rain Shield Wiper." Retail \$1.00—Costs (25c). Sold Clear and Rainy Days. No Cloth—No Paste—No Attachment. (1) Rub keeps Windshield Clear (48) Hours. Experience Unnecessary. Nullite Corporation, Hartford, Conn.

MAKE money silvering mirrors, all kinds plating, knives, spoons, auto headlights. Outfits furnished. Free Booklet. International Laboratories, Dept. 27, 311 Fifth Avenue, New York.

SALESMEN, can make \$5.00 a day selling our calendars, pencils, signs, advertising novelties, yardsticks, whistles, etc. Liberal terms. Sells entire year. Fine side line. Local and traveling agencies. Model Calendar Co., Dept. 309, South Bend, Indiana.

EASY, pleasant work for mechanics, shop men, clerks, during spare hours, will add many dollars to their salaries. Also want persons who can give full time. Big wages assured. Novelty Cutlery Company, 27 Bar Street, Canton, Ohio.

\$60-\$200 A WEEK. Genuine Gold Letters for store windows. Easily applied. Free samples. Liberal offer to general agents. Metallic Letter Co., 434A North Clark, Chicago.

AGENTS—Everywhere, women's and children's guaranteed shoes direct to wearer. We deliver. A. P. Condon, Sales Manager, The Allen Shoe Co., 110 Summer Street, Boston, Massachusetts.

MEN, to sell regular \$1.00 and \$1.50 silk and knitted ties for 35c and 50c. Make \$15.00 daily. Write for particulars. American Cravat Exchange, 621 Broadway, New York.

AGENTS, both sexes, we manufacture and control new household article. Fast seller. Big profits. Exclusive territory. Write now. Connelly, 123 Liberty St., New York.

PATENTED Cigar Lighters with Glass Advertising Front. Also Electric Cigar Moisteners. Wonderful Sellers. No Competition. Big Steady Profits. Proof, Cuts, Sales Plan Free. Drake Mfg. Co., Dept. P, Milwaukee, Wis.

More Money Making Opportunities
on pages 8 to 26

It Was REAL FUN -Learning to Play the Piano in 90 Days

By A Wife

We had been married only three years, and already Bob's love for me was slipping. Instead of remaining in evenings, he used to spend his time elsewhere, or devote his time to playing on his violin, entirely indifferent to me. Frankly, I was living through days of misery.

One day, while reading a magazine I came across an amazing story—of a woman who had learned to play the piano in 90 days! Was it possible? Fascinated, I read on and on, and learned how she had mastered the piano by herself, in her spare time, without a teacher.

I stopped. A wonderful thought had occurred to me. Why couldn't I do what this woman had? And—how happy I could make Bob by accompanying him on the piano! Full of enthusiasm, I wrote to the U. S. School of Music for their course. I, who had never known a single thing about music, was absolutely astonished at the remarkable simplicity of their print-and-picture method. As easy as the A. B. C!

My progress was wonderfully rapid, and soon I was rendering selections of music which pupils who study with private teachers for years can't play. You see, through this amazing short-cut method, all the difficult, confusing, tiresome parts of music are eliminated and the playing of melodies is reduced to a simple, easy-to-understand method that any one can follow with ease.

But my greatest happiness came the day that Bob found out. Words can't describe his look of astonishment. And what a change seemed to come over him as he eagerly drank in my story. Then it was I realized what music had meant to him. As he expressed it, playing the violin was absolutely flat without the accompaniment of a piano.

Today Bob finds new delight in his violin, and I have kept right on with my piano studies. Our musical evenings are a marked success and we are able to offer our friends entertainment they enjoy.



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AGENTS steady income. Large manufacturer of handkerchiefs and dress goods, etc., wishes representative in each locality. Factory to consumer. Big profits, honest goods. Credit given. Send for particulars. Freeport Mfg. Co., 24 Main Street, Brooklyn, N. Y.

WE start you without a dollar. Soaps, extracts, perfumes, toilet goods. Experience unnecessary. Carnation Co., Dept. 21, St. Louis.

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BIG profits in Card Signs for every business. Sample 10c. Signs, 819 St. Louis, New Orleans.

FLORISTS Plant Food promotes luxuriant growth, prevents disease. Price 25 cents. Agents profit large. DeMuth, Camden, Michigan.

OFFICE Necessity—Costs 25c; sells \$1.00. Many buy hundreds. Big repeater. Manufacturer, 3240 North 13th, Philadelphia.

SELL necessities. Everybody needs and buys the "Business Guide." Bryant cleared \$800 in July. Send for sample. It's free. Nichols Company, Box 1B, Naperville, Illinois.

FORMULAS, Processes, Trade-Secrets—Different, dependable, profitable. Catalog free. C. Thaxly Co., Washington, D. C.

AGENTS sell Wolverine Laundry Soap. Wonderful repeater and good profit maker. Free auto to hustlers. Wolverine Soap Co., Dept. B40, Grand Rapids, Mich.

WANTED County Distributors for World's Fastest Selling Automobile Accessory. Write D. Benross Co., 384 East 144th Street, New York.

AGENTS. Get my proposition. Brings dollars. Bedell Co., 789 S. 18th St., Newark, N. J.

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WE pay \$200 monthly salary, furnish car and expenses to introduce our guaranteed poultry and stock powders. Bigler Company, X371, Springfield, Illinois.

FORMULAS—Dependable manufacturing formulas with complete working directions. Charges reasonable. Write me, S. Viggins, Chemist, 135 Meadow St., Pittsburgh, Pa.

\$300 PROFIT Weekly, installing automatic advertising directories in hotels, etc. The 12 ads sell quickly. Automatic information of train schedules, road maps, etc. Flash illuminated on opaque glass. Get particulars. Territory. Yes! Sterling Service, Ocean View, Va. 136-R.

AGENTS: Bill Omels, just an ordinary fellow, made over \$5000.00 during 1923 selling our \$1.50 kitchen specialty. He is now a district manager. We are offering you the same proposition—an opportunity as big as you want to make it. You can do what Omels did. Write today, M. H. Tyler Mfg. Co., Dept. P-1, Muncie, Ind.

TAILORING Salesmen—Fastest selling line, suits, overcoats, made to measure—\$32.50—one price, all wool. Profits in advance. Biggest old reliable house. W. D. Smith & Co., Dept. 67, established 1895. Chicago.

SELL new Automobile Smoking Set. Latest Advertising Specialty. Fastens on dash. Place for matchbox, cigarettes and ashes. Newton Mfg. Co., Department AZ, Newton, Iowa.

MAKE \$17 day—Finest extracts, food products, toilet preparations, household necessities. Credit; sample case free. Write for amazing offer. Perkins Products, B-26, Hastings, Nebr.

MAKE \$31.00 Profit—Cost you \$1.50 Complete Gold Monogram Outfit. Transferred instantly on automobiles, trunks, bags, windows. Experience unnecessary. "Free Samples." Nullife Monogram, Hartford, Conn.

AGENTS—Don't answer this ad if you don't mean business. But if you're out to make money and want a fast-selling proposition, address The Horsey-Bassett Company, Dept. PS-1, Crisfield, Maryland.

WHERE to buy 12,000 articles Wholesale. Actually worth \$50. Enclose stamp. Wholesale Supply Co., Valdosta, Ga.

NEWEST invention! Improved Pocket Calculating Machine. Does work of expensive machine. \$15.00. Agents: Big Profits! Schultheis, 1065-C Bergen Street, Brooklyn, N. Y.

100 AGENTS to sell auto accessories, write for sample. Box 4, Elmira, N. Y.

MAKE \$8 a day selling Imported Bamboo Fountain Pen. Whirlwind seller. Free sample. Mohler, Dept. 6, 416 S. Dearborn, Chicago.

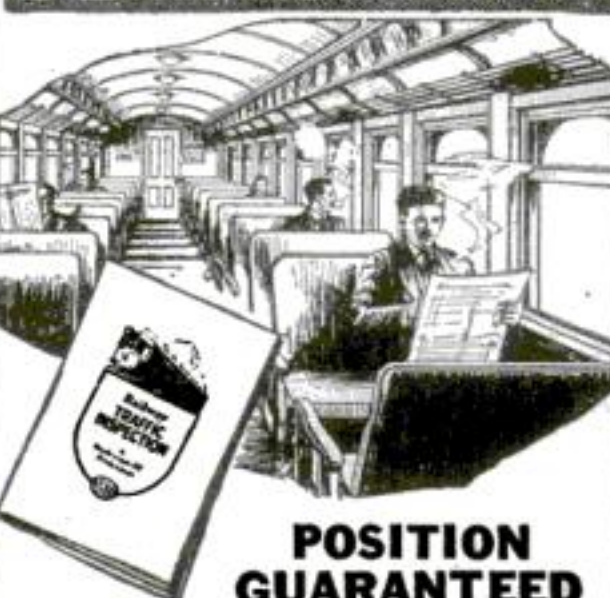
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MAGIC Pomade keeps hair combed. Selling course free. Blackburn, 3288 Beresford, Cincinnati, Ohio.

USE our handsome Catalog; get orders from every home for Dr. Blair's famous home products. Liberal Pay. Dr. Blair Laboratories, Dept. 525, Lynchburg, Va.

More Money Making Opportunities
on pages 8 to 26

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SALESMEN to sell our Electric Heaters. Sell for \$11. Send \$5 for sample. Homeyer Machine Products & Mfg. Co., 1385 E. 17th St., Cleveland, Ohio.

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CAN you sell Ford size tires at \$3.50 each? Write for plan. Details free. American Accessories Co., Sales Dept., 79, Cincinnati, Ohio.

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NEW Patented Household Article; 300% profit, sold on Money Back Guarantee; everybody buys; wonderful money maker. Specialty Mfg. Co., 744 Lincoln Bldg., Detroit.

GET in business for yourself. We want distributors in every town and city for an article used in every home. Good opportunity to build up a business for yourself without investing any capital. Write Cien-So Products Company, 433 Masonic Temple, Charleston, West Virginia.

SALESMAN: If you think in terms of \$6,000 this year, write me. Strong retail store line. Advertised nationally. Established company. Liberal weekly advance to producer. The Continental Co., 1920 Euclid Ave., Cleveland, Ohio. Dept. 201.

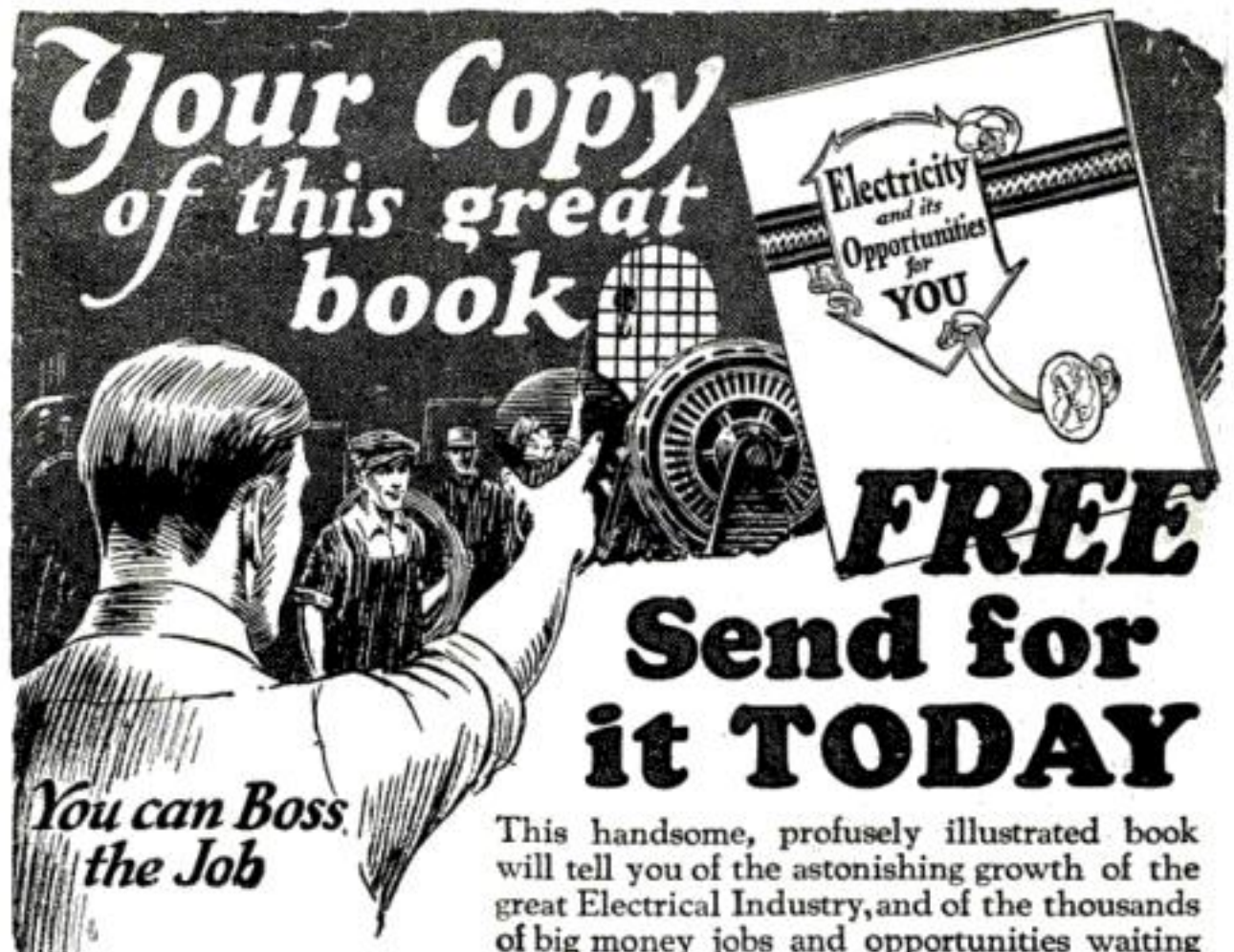
EIGHT Quick-Selling Auto Accessories! Windshield Cleaners, Side-wings, Grease Retainers, etc. Low prices. Big profits. No investment. Salesmen write quick to Jubilee Company, 44 Sta. C, Omaha, Neb.

AGENTS and medical men are averaging Twenty Dollars daily selling Dr. Nardine's remedy, so can you. Nardine Medical Co., Johnson City, N. Y.

SALESMEN: a real, high-class proposition selling new money-making specialties to all dealers. We guarantee minimum of \$40 weekly and traveling expenses against commissions. Live wires actually making \$5,000 to \$12,000 yearly. Big commissions. Splendid, workable selling plan. A square deal and your own business easily established. Write A. K. Main Co., Cedar Rapids, Iowa.

AGENTS—Get our big sample assortment, free. Tea, coffee, extracts, spices, food products, things people eat, 240 fast sellers. Harley Co., 313 Harley Bldg., Dayton, Ohio.

More Money Making Opportunities
on pages 8 to 26



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More Money Making Opportunities
on pages 8 to 26



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More Money Making Opportunities
on pages 8 to 25



How to Discover and Correct Your Weak Points

What is holding you back? Is your mental engine missing on at least two cylinders? A Pelmanist's brain hits on all six. A Pelmanist is *alive*. That is why over 650,000 of them are climbing the hills of Business "on high."

OVER ten million Americans drive cars, and they all know that they can't expect full, maximum power and speed from an engine that is "missing," or choked with carbon. The moment a "knock" or a "pound" appears, they have it fixed.

But thousands of these same Americans go around with their much more valuable brain-machinery groaning and creaking for lack of a little intelligent attention and care!

They try to make the grade of success with the WILL-POWER cylinder not firing at all—or with a sooty spark plug in the PURPOSE cylinder. Or may be they are not getting the help they could from CONCENTRATION, OBSERVATION, IMAGINATION, or MEMORY. And the worst of it is that they don't know where the trouble is! They just go "knocking" and "hammering" along through life, wondering why they can never catch up with any of the BIG rewards that always keep disappearing just 'round the turn of the road ahead.

Only a "well-tuned" brains gets what it means

Perhaps you have the idea that you lack WILL-POWER. So you set out to develop it. But, even if you succeed, it isn't going to bring you the rewards you want—not all by itself.

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Think of the man or woman you admire most for achievements, and see if this person is weak in any one of these faculties. It is more than likely that he, or she, has a well-tuned brain engine—running sweetly along—always giving maximum power and speed—always getting the most out of life.

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opportunity. He sees it in places where the average eye sees nothing. Proper training has sharpened his observation and all his other mental faculties. He has a purpose in life and he *knows* he can achieve his aim. His concentration and imagination are strong; his will is powerful—in a word, he is "captain of his soul!"

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Send Now for This Free Proof

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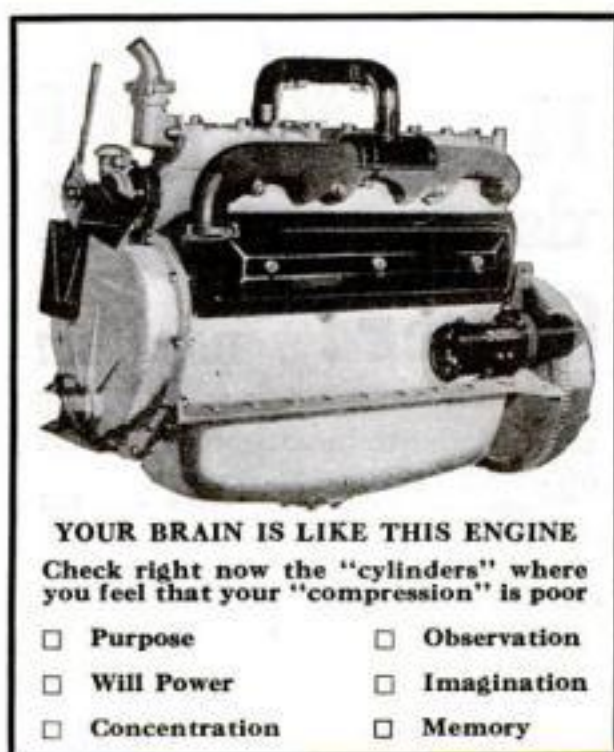
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taste for study, and broader lines of thinking and reading; and have secured a position much more adapted to my best experience and capabilities. I feel a thousand times repaid for starting the course."

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I'm Going South
You're In Kentucky, Sure As
You're Born
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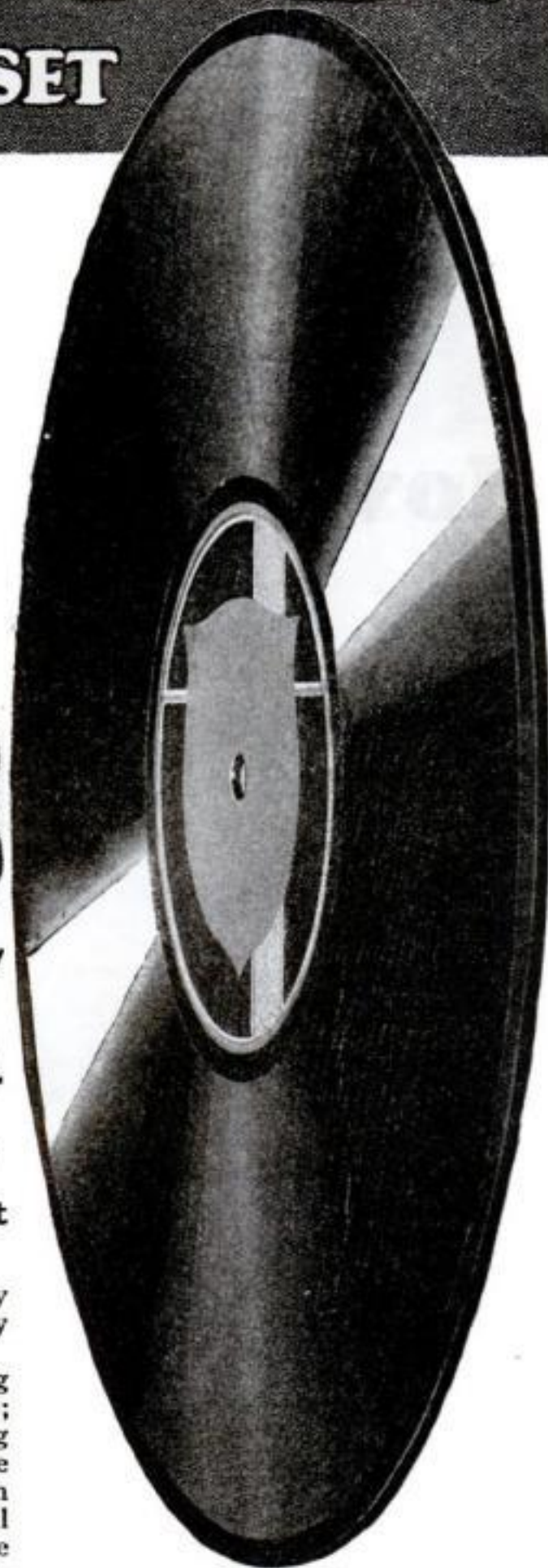
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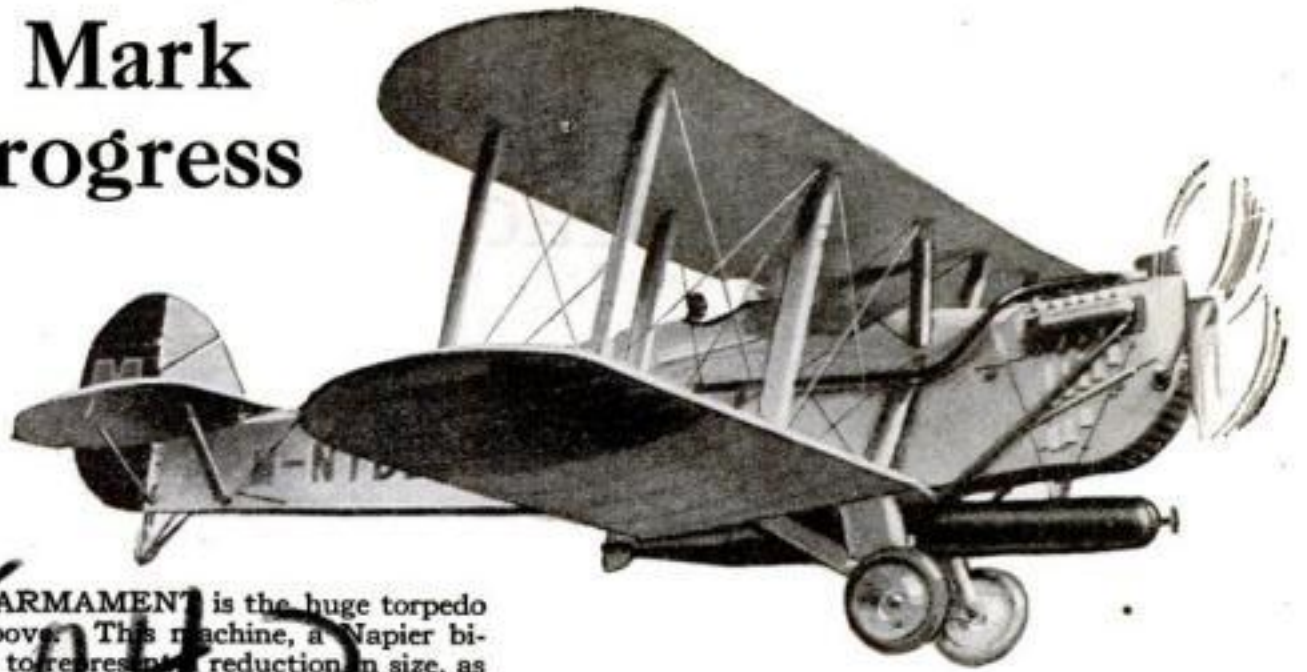
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Machines that Mark New Aerial Progress

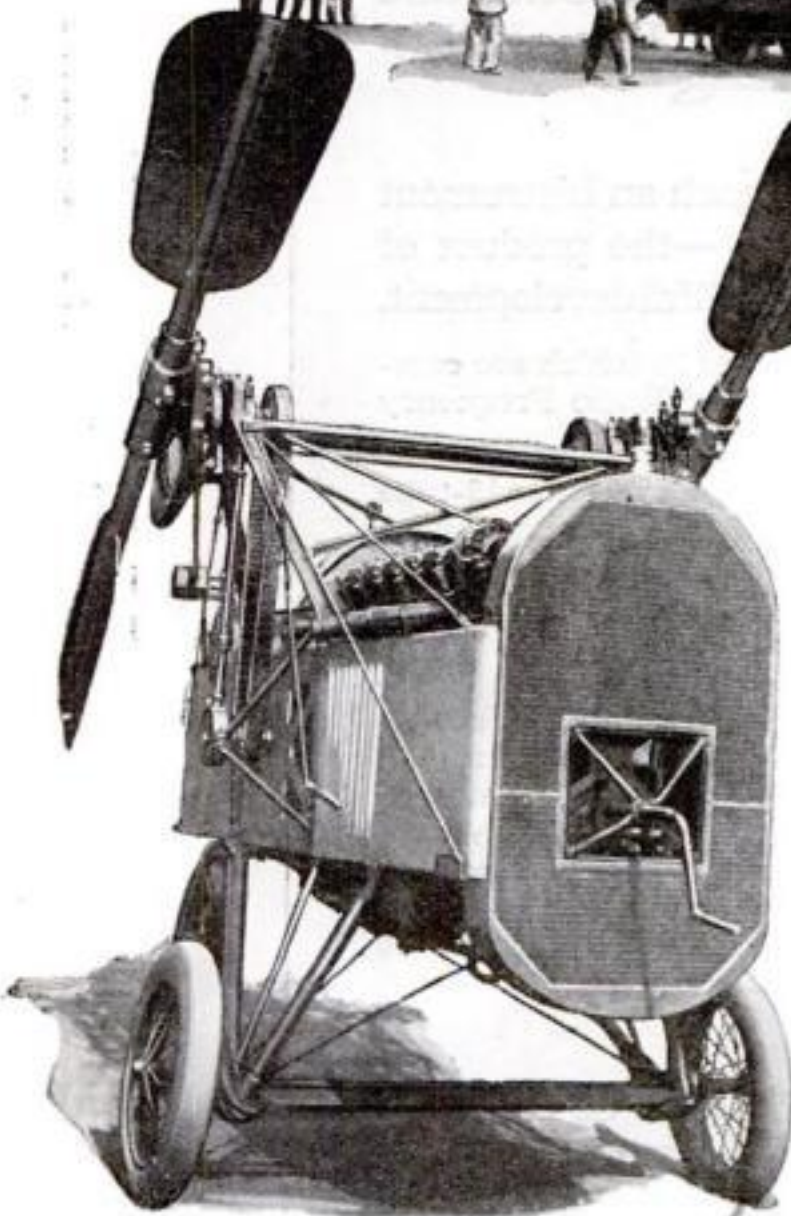
Giant Airplanes and Odd Helicopters to Conquer the Skies



THE LAST WORD IN NAVAL AIR ARMAMENT is the huge torpedo carrying airplane shown in full flight above. This machine, a Napier biplane built for the British navy, is said to represent a reduction in size, as compared with other types, without in the least sacrificing lifting capacity.



HERE IS THE WORLD'S LARGEST HYDROPLANE, recently completed at St. Raphael, France. The machine is a huge double biplane weighing 10 tons and driven by two rotors of 1000 horsepower each. The great streamlined body forms a spacious air coach handsomely furnished for passenger transportation. This body is built on a broad pontoon capable of riding the waves in the roughest weather. Note the unusual arrangement of the four wings in pairs.



© U. & U.

THE LATEST CONTESTANT for the \$250,000 British Air Ministry prize, offered for a practical vertically rising machine, is the Omnivator, pictured above. Its two side propellers are designed to imitate the movement of a bird's wings. The inventor, E. P. Johnson, of Chicago, claims it will fly backward or forward.



A HELICOPTER BUILT ON AIRPLANE LINES has been designed by William J. Beach, author-inventor, of Australia and New York City, who is shown above demonstrating a small model of his invention. The upward movement of the strange machine is said to be produced by revolving planes acting on a series of four shutter-like planes that stabilize the machine.

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Type CR-12. A 4-tube Re-
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Perils of Polar Flight

*For want of a nail the shoe was lost;
For want of a shoe the horse was lost;
For want of a horse the rider was lost—
All for the want of a horseshoe nail!*

ARCTIC exploration is just like that. One tiny oversight, one nail or bolt or lacing missing at a critical moment, and the lives of daring men may be needlessly sacrificed.

No military campaign ever was planned with greater attention to detail than that of the Polar Air Expedition which the United States Navy announced for the dirigible *Shenandoah*.

Lessons of the Past

After more than a century of international effort, stippled with tragedy and crowned by Peary's superb achievement of the North Pole, we have come at last to know the incredible complexity as well as the unavoidable peril of polar work.

Consider the field of action. On the American side Nome is the most northern place available for a base. Point Barrow, Alaska, for instance, is not open until August. And ice conditions are so uncertain there that a ship could not stay long enough to be of real help to an air expedition. Somehow we think of Alaska as having the North Pole in her back yard, so to speak. Yet it is 1560 miles from Nome to the earth's apex!

Fierce Arctic Winds

Twice 1560 miles is more than 3000 miles. If an airship has a cruising radius of 4000 miles she theoretically can fly from Nome to the Pole and back with safety.

But a cruising radius is figured for still air. And Bering Strait is a veritable funnel. Cold northerly winds pour through it for weeks at a time. If the wind blows 40 miles an hour against an airship and the ship is making propeller revolutions for 60, her advance over the ground is only 20 miles an hour. With such a handicap the Nome-Pole flight would become proportionately 9000 miles! No airship ever designed could tackle such a journey.

How Our Navy Experts Are Preparing for Conquest of Far North by Airship

By Lieut.-Comm. Fitzhugh Green, U.S.N.

Member of the special Naval Arctic Air Board appointed to supervise the "*Shenandoah's*" cruise over the Pole



In addition to all the icy terrors that in the past have confronted explorers in their daring and often disastrous attempts to reach the top of the world by ships and dog teams, the crew of an airship must be prepared and fully equipped to meet new and uncounted perils in an attempted polar flight. Buffeting air currents swirl about the Pole. Projecting nubbles of ice make the landing of an airplane hazardous, and the landing of a dirigible out of the question. The composite photograph above vividly illustrates these hazards

The point I wish to emphasize is that the Arctic is a vast place—something more than 3,000,000 square miles in the polar basin, one third of which is totally unknown! Enormous distances must be covered. No bases exist save those

especially established. Wind conditions are little more than a guess. Hence, months of preparation in a myriad minute ways are essential for a final sally against the demon blizzards of the north.

The practical purpose of an air expedition northward is two-fold: First, exploration of the unknown area of the Polar Sea north of Point Barrow. Second, establishment of the practicability of a transpolar route between Europe and Asia, with resulting trade advantages.

To Seek Unknown Land

The first objective is the so-called "Pole of Inaccessibility." This is the center of the unknown area lying about 500 miles north of Point Barrow. Systematic flights over it either by plane or dirigible will determine whether or not land lies there.

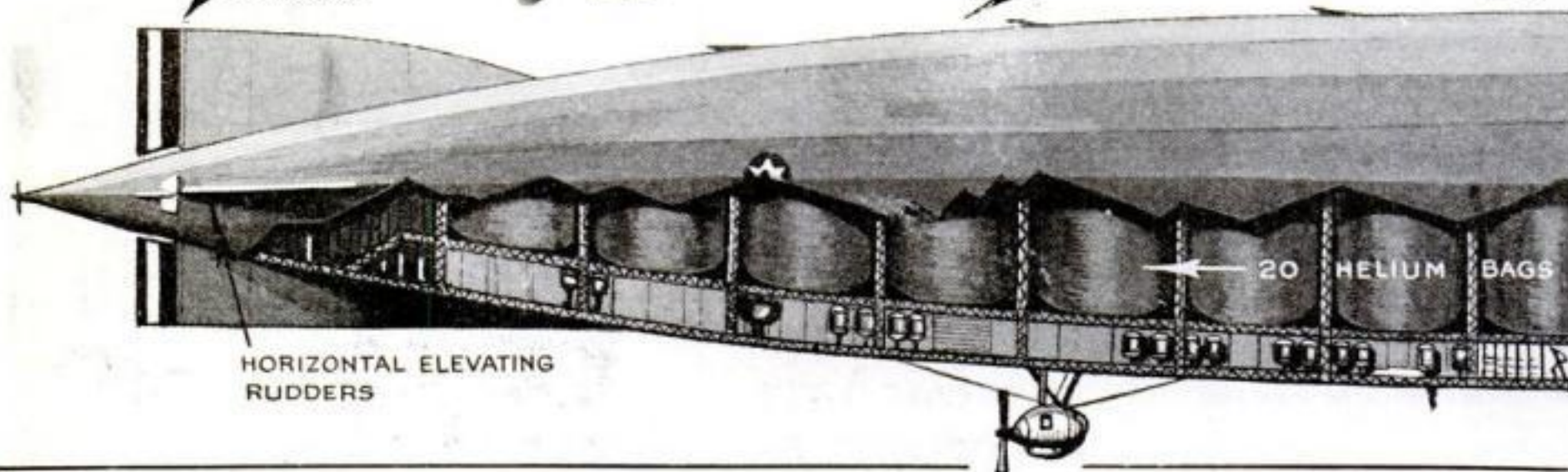
The second objective is not only the accomplishment of a transpolar flight, but the collection of aerological data that will enable American commercial enterprise to enter this field with some idea of the feasibility of an arctic shortcut to Asia and Europe. Such accomplishment is in line with the peacetime uses of our naval forces. In like manner the Navy operates two ships engaged in scientific research for the Bureau of Fisheries.

Cold the Least Obstacle

Strange as it may seem, cold will be the least of all obstacles. Arctic temperatures are no more intense than those often experienced in our northern states. For five weeks in summer much of the Arctic receives more heat to the square mile than that received at the equator! Our Weather Bureau reports show that a temperature of 100° F. in the shade has been recorded in Alaska! Airplanes already have been flown in temperatures far lower than any that will be encountered on the coming expedition.

The thing about arctic cold is its persistence. A recording thermometer on the Polar Sea in any summer month will show about 30° F. day after day with but a

25529

ENTIRE SHIP GIVEN NEW COVERING
OF GOLD-BEATER'S SKINVERTICAL STEERING
RUDDERS

Science and Chance Play for High Stakes at the Top of the World

ONE important point to bear in mind in connection with the proposed polar exploration by dirigible is that in any case such an expedition can never be merely a spectacular feat of dashing adventure. It is essentially a useful undertaking of exploration, which, if successful, promises results of tremendous scientific and commercial importance.

In the accompanying article, Commander Green depicts vividly the almost unbelievable difficulties of arctic flying. He describes specific measures of the Navy to foresee these difficulties as far as possible before undertaking any flight as spectacular as has been proposed for the *Shenandoah*. Yet Uncle Sam's aviation experts know well that an infinite number of obstacles lie in wait for the forthcoming attempt to conquer the fierce air currents that swirl about the top of the world—obstacles that cannot be anticipated, nor guarded against by the most careful prepa-

ration. These unknown foes, as Commander Green points out, are reared by Chance, upon whose bounty those who dare the air in dirigibles are absolutely dependent for their success or failure. Witness the recent appalling disaster to the giant French dirigible *Dixmude*.

To be sure, the *Shenandoah* gave a splendid account of itself when it broke away recently from its mooring mast at Lakehurst, N. J. But such a ship cannot land as an airplane can. If its supply of fuel gives out, it is at the mercy of capricious air currents to a greater extent than even a balloon would be.

Maneuvering a dirigible near the ground is known to be virtually impossible. With helium gas supplying the lifting power, as in the case of the *Shenandoah*, great heights cannot be attained, because helium, expanding in rarefied atmosphere, would cause the

bag to explode. That is why the Navy's plans for the trip have been shaped so that she must circle the United States on her way to Nome; she cannot ascend to heights sufficient to clear the mountains that lie in the path of a direct route. The theoretical cruising range of a dirigible, as Commander Green points out, is reduced appreciably in any but calm air. In other words, Chance plays a not unimportant part.

So the crew of the *Shenandoah*, if they start on their voyage over the frozen seas of the north are facing all the dangers that ever confronted a polar expedition, plus unknown and uncounted dangers. They will be adventuring quite as much as the pioneer polar explorers whose expeditions almost invariably resulted in disaster.

The whole world will wish them success, but the world must not be carried away by the glamour that surrounds their hazardous and daring adventure.

degree or two variation on either side.

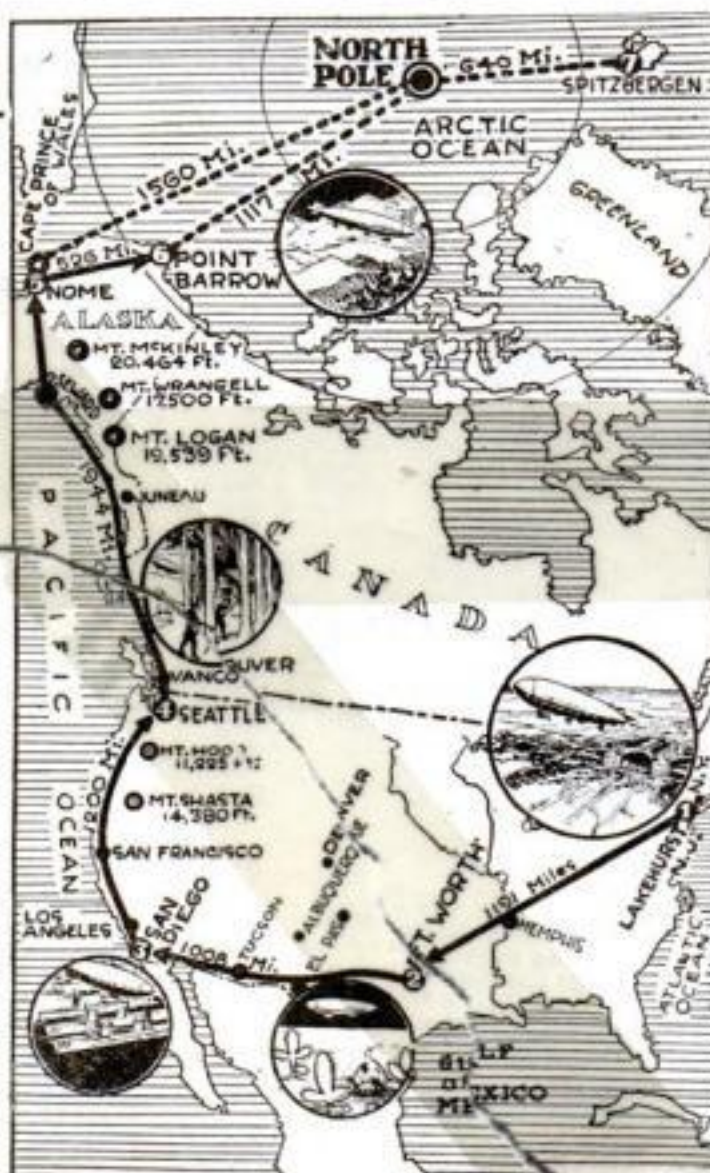
"We never seemed to get thawed out!" exclaimed a friend of mine who has done some flying in Spitzbergen.

Coupled with unvarying low temperature is the uncomfortable dampness of the arctic summer air.

Both of these features have a bearing on the choice of equipment for the expedition. Lubricating oils must be light enough, yet able to stand exposure to severe cold in case any engine is forced to remain north through the winter. All metal parts and fittings must be surfaced to withstand the effect of the air's high moisture content.

In allowing working time for such tasks as erection of mooring masts, hangars, and for repairs, a certain percentage always must be added for the numbing wind in which the men must labor. A freezing temperature is not severe. Often our carpenters work outdoors in colder weather than that. But in the north, where the sun's angle is low, where the cold wind's searching fingers never cease their prying, and where there is no such thing as noontime warmth, outdoor work becomes a serious problem indeed.

The aviator, confined to his narrow cockpit or control car, is supplied with special garments. Next to his



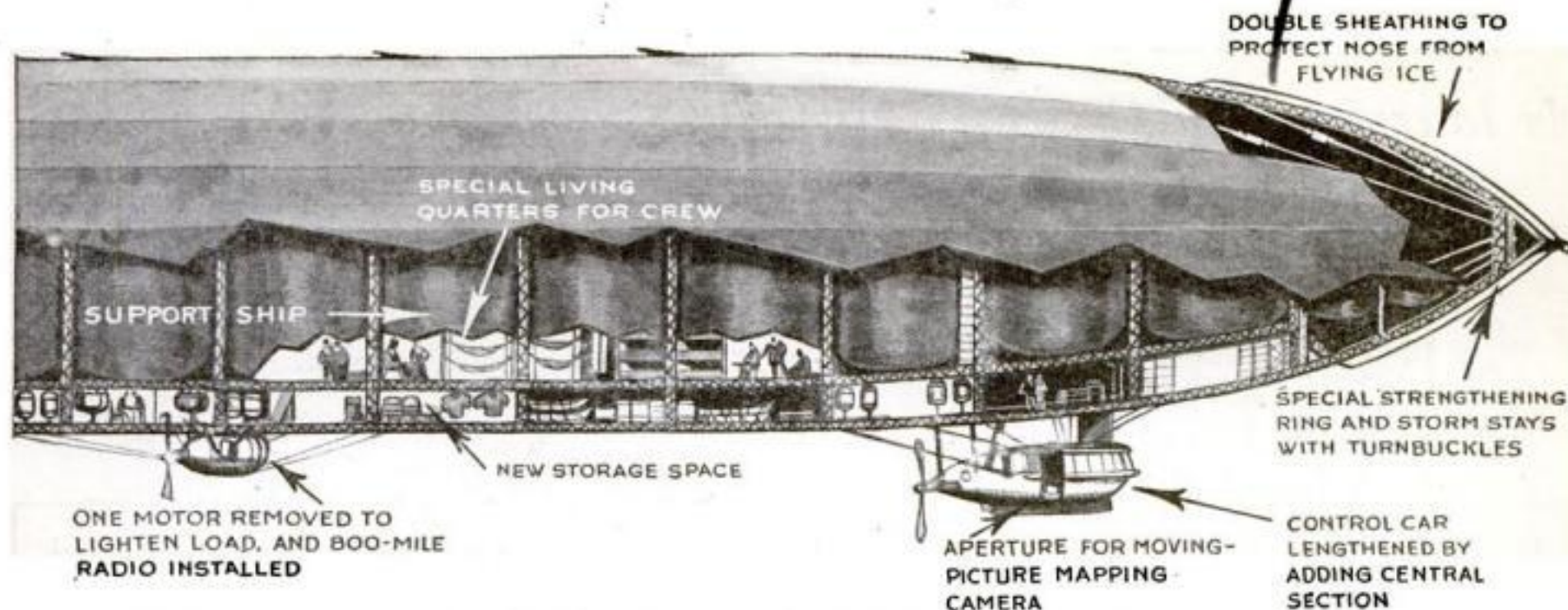
The contemplated route of the *Shenandoah* from her hangar at Lakehurst, N. J., to the proposed Alaskan base at Nome, thence 1560 miles to the North Pole. The total distance from Lakehurst to the Pole over this circuitous course is 6903 miles.

skin he wears ordinary woolen underwear. Then comes an electrically heated suit of asbestos-like material. Outside he wears a closely woven windproof coat of burberry or skin.

But cold can be anticipated. Wind cannot be. Winds are caused largely by heat. At the equator hot air rises and flows northward. Speaking broadly, in the arctic regions it cools and somewhere over the Polar Sea falls and pours south again. Theoretically it might thus be possible to fly high and have a fair wind to the Pole; then, by coming down near the earth's surface, to have the wind aft coming back.

The trouble is that we don't know just what to expect. The atmosphere at the poles is oblate or flattened, just as is the earth, only immensely more so. That is to say, while the atmosphere over the equator is thrown out by centrifugal force, near the Poles the reverse is true, and the depth of the atmosphere is tremendously decreased. Hence conditions of flying near the North Pole at an altitude of 5000 feet may differ greatly from those found over the United States at the same altitude.

Shortness of breath is a common result of rising high above the earth's surface. Most aviators breathe through their mouths at altitudes



This diagrammatic cut-away view of the *Shenandoah* shows proposed alterations designed not only to protect and aid the great air cruiser in battling polar gales and ice storms, but to provide comfortable quarters and scientific equipment for the long cruise of exploration

higher than 12,000 feet. At 15,000 feet the mere turning of the body to look around may aggravate breathlessness enormously. Since cold accentuates this respiratory weakness, it becomes one of the major problems of arctic flying.

One of the curious features of arctic navigation is the fact that the compass course toward the Pole from Point Bar-

row is a little *south of west*! The north magnetic pole lies in the North American archipelago above Canada. Toward it the compass needle points. Hence the paradoxical course that must be steered to reach the geographical pole.

There is a serious side to this matter. Static electricity is generally believed to be greater in polar regions than elsewhere

on the globe. The aurora depicts upper air conditions in this respect. Moreover, the directive force of the magnetic pole on the needle is slight in high latitudes. Altogether the compass is a frail assistant.

There are variations of the compass over the Polar Sea that never have been investigated. If a dirigible's navigator at the Pole should wish to head for Spitzbergen, 630 miles due south, he would have something to worry about when he began to set his course. Frequent sun observations would be his best bet. That is, if there were no arctic fog on the job to prevent him.

The thrilling possibility of the expedition is that we may find land. We must be prepared to find it, at any rate, and this opens up a whole new list of troubles.

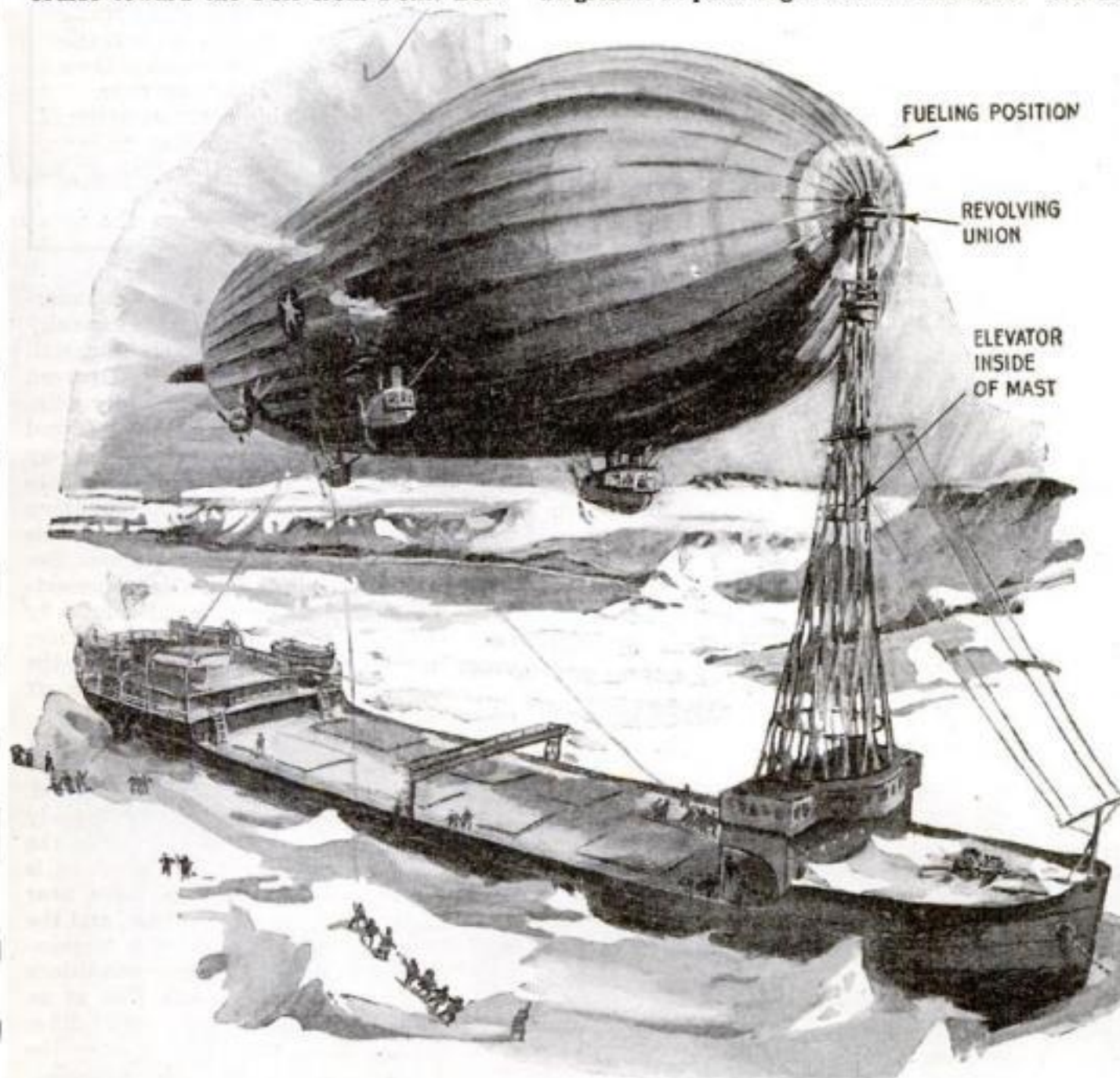
Dangers of Landing

Take the airplane. To fly safely over the polar pack a plane must be equipped with pontoons for landing in the water that forms on the ice in summer, or in the open water between floes. On these pontoons must be runners for landing on ice or snow, if necessary.

So far so good. But every arctic traveler knows that visibility conditions on the ice pack in broad daylight often are so trying that even a man afoot constantly stumbles over projecting nubbles. Diffused rays of the sun and lack of shadows make the roughest ice-field look smooth as a table from an altitude of 500 feet. To land under such conditions would mean to wreck one's plane.

A dirigible is even more severely handicapped. At the present point of progress in this form of airship, a safe

(Continued on page 150)



To provide dirigible anchorage in the Far North, the Navy is developing this type of mooring mast to be carried by supply ships. In its construction the lessons learned when the *Shenandoah* broke away from her mooring mast are being utilized.

The mast will be built to withstand an end-on pull greater than that produced by the 70-mile gale at Lakehurst. It will be equipped with elevators for the crew, and pipe lines for water and gasoline. Motor winches will carry heavy loads up to the ship

"My Fellow Scientist—The Rat"

An Interview with Dr. E. V. McCollum, Famous Authority on Diet

By Norman C. McLoud

DR. ELMER V. McCOLLUM, professor of biochemistry at Johns Hopkins University, one of the world's leading authorities on food and diet, set out some time ago to find what foods were best for human beings. Man did not know, so Doctor McCollum asked the rat. How well the rat has answered is indicated by the fact that many scientists give Doctor McCollum credit for having done more than any other single investigator to determine the effects of food on the human body.

Advanced Food Science

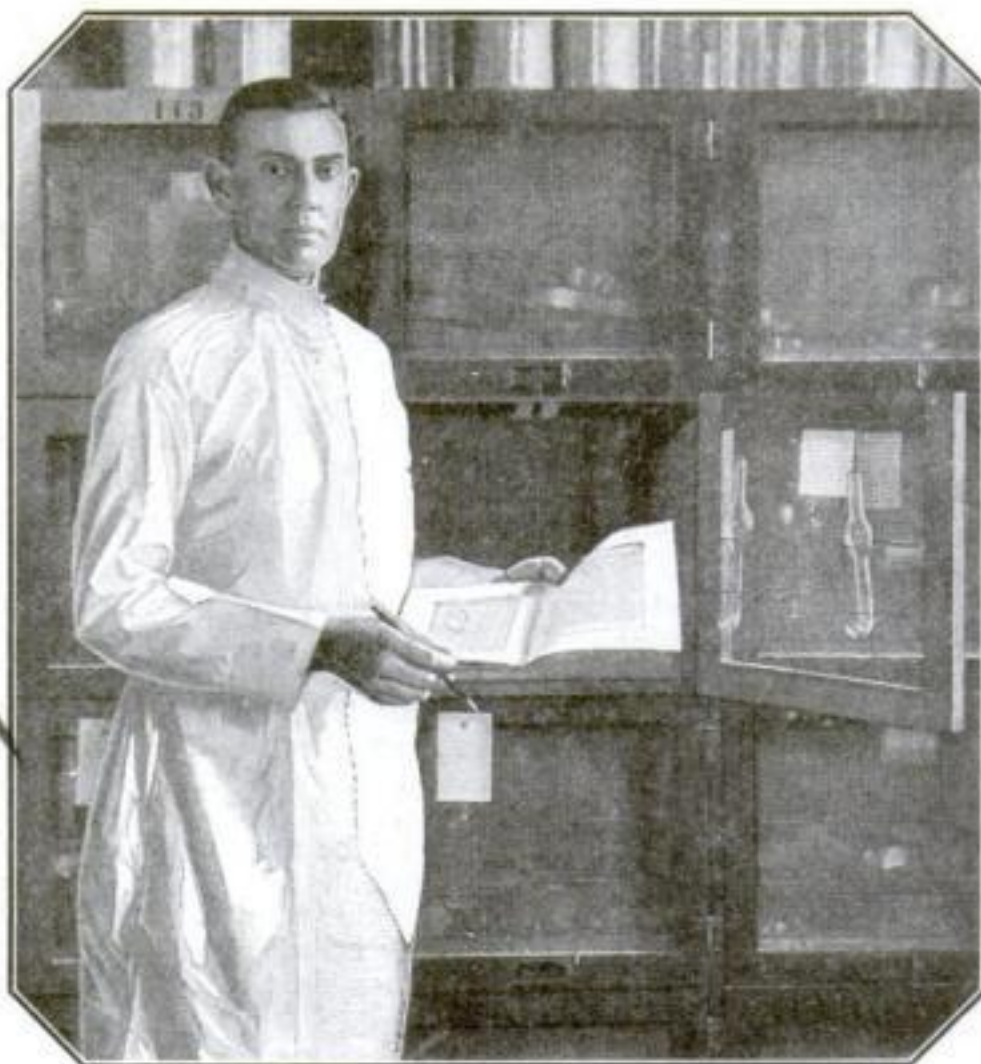
But Doctor McCollum is not yet satisfied with the results of his work. He is still experimenting with rats, and with their aid expects to establish new principles of nutrition, which, if it is safe to assume, will mean a longer, happier life for you and me. His laboratory-workshop at Johns Hopkins University in Baltimore is the seat of epoch-making revelations. In matters of food he is an investigating pioneer. To visit him is to have a glimpse of the show-window of advanced food science.

Rats play an important part in the story of the life and works of this scientist. They scamper through the tale as through a cheese shop. In the contest with mice for this distinction the rats triumphed because of their dignity. A mouse is frisky and uncompromising; a rat is gifted with poise and understanding. It is because of this superiority that McCollum has been able to make rats his fellow workers in scientific discoveries.

A Laboratory Full of Rats

In his laboratory are hundreds, sometimes thousands, of them. Cages in rows line the walls and the floor, each heavily screened. Here and there the quick flitting of a tail shows that a cage is occupied. He feeds his rats with this food and that, observes the effect on them, and then translates his conclusions into terms of food for human beings. By regulating the diet of his rat associates, Doctor McCollum makes them sick or well, small or large, thin or sleek, contented or ill-tempered. By what may be called improper feeding he can make a rat prematurely old, and by proper feeding can make it retain the characteristics of youth.

These things he has been doing for about 13 years. During this time he has been storing up valuable facts relative to the effects of various foods and animal



Dr. Elmer V. McCollum, world-famous authority on food and diet, at work among his rat cages in his unusual laboratory at Johns Hopkins University. In hundreds of experiments with rats, he has learned much concerning the influence of food on the bodily welfare of the animals, which he has translated into terms of the human body. These results have thrown important light on the food requirements of human beings.

organisms. These, formulated into general principles regarding human diet, he expects will lead gradually to a longer, healthier life for mankind.

"As a research assistant, the rat is an animal after the experimenter's own heart," he told me. "Gentle, easily handled, and amiable, the rat may be weighed in five seconds. Keeping his record is a simple undertaking. Other factors in his favor are his rapid growth and a generous number of offspring, two points of importance in the study of food consequences. With the rat we are able to carry on what amounts to cross-examination. Giving him food of known elements, we can ask him whether it is satisfactory and demand that he answer 'yes' or 'no.' The animal quickly answers by his growth or his lack of growth.

"In this way the rat is just as accurate as the chemist's beaker, although some chemists are inclined to scorn the use of the animals as lacking the charm of working with crystals and chemical formulae. Call him a laboratory animal or an animal laboratory, as you please, the rat is an ideal fellow scientist."

What Diet Does

Some of the physical conditions produced in the rats, simply by regulating their diet, are amazing. Thus a diet containing every element necessary to physical growth except proteins—which man takes mostly from meats—causes a growing rat to become dwarfed. A later change in the diet to include the element formerly lacking will result in growth.

Regulation of the diet will make a female rat barren. It will even destroy the mother instinct and cause the mother rat to attack and kill her young. This is an especially remarkable demonstration of the effect of food on animals, since the mother instinct in rats is very strong.

Departures from the normal diet is found to produce diseases of various sorts—nervous, as well as physical. They also will cause a year-old rat, which should be in prime vigor, to take on the aspect of an aged animal of three years. One experiment that Doctor McCollum has performed repeatedly will suggest an analogy in human life. Two groups of rats of the same age, one fed on an adequate diet, the other on diet insufficient in some particular, apparently will thrive equally for a while. After six months or so, though, the rats insufficiently fed will begin to fail. Nervousness and irritability, bodily emaciation, then death will be their portion, while the other rats will remain plump, strong, bright-eyed, and serene until old age comes upon them.

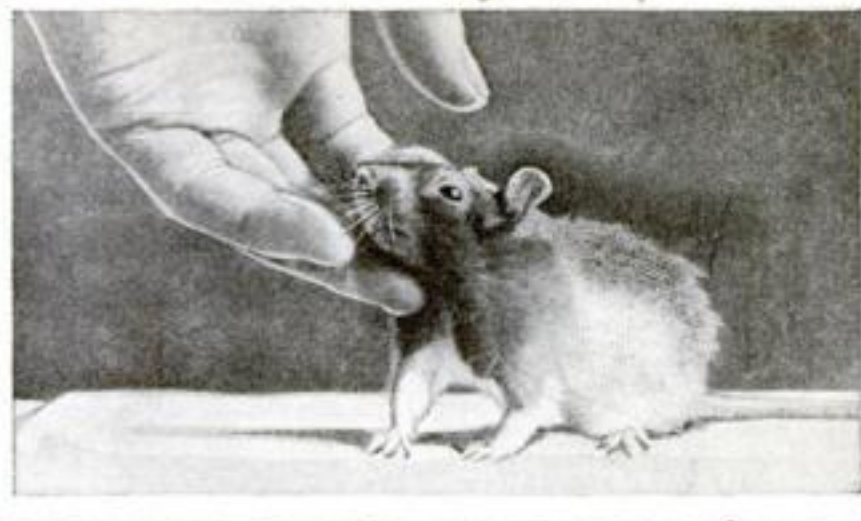
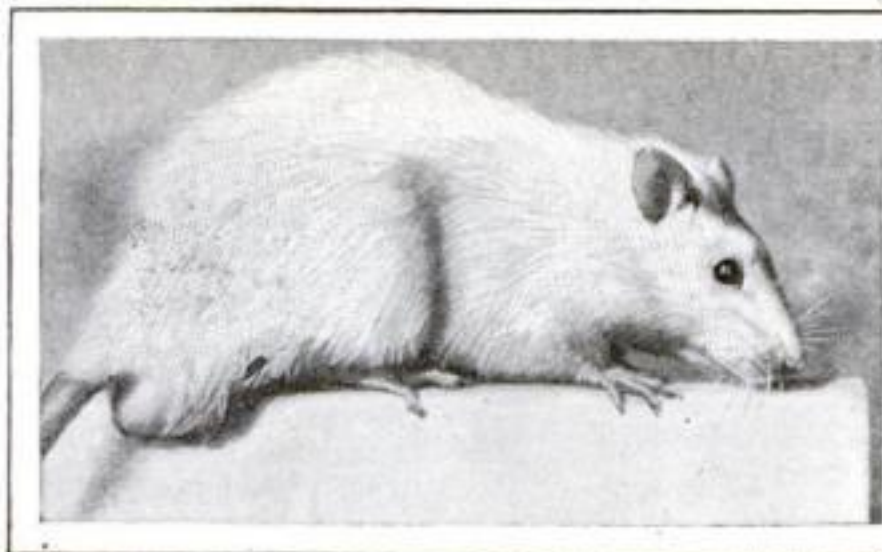
In one cage I noticed a decrepit, gray



One ingredient—dry whole milk—made all the difference in these two rats, both of which were 308 days old when photographed. In other respects their diet was the same—bolted wheat flour, degerminated cornmeal,

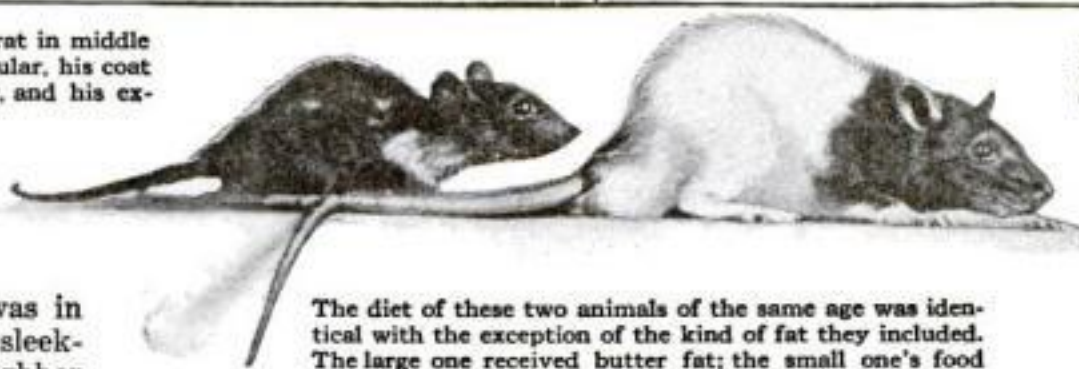


cooked and dried potato, peas, navy beans, beets, turnips and beefsteak. The puny, prematurely aged rat at the left lacked the milk diet. The other, receiving the milk, grew much larger, retaining youth and vigor.



Above: A well-nourished rat in middle life. He is sleek and muscular, his coat is smooth, his eyes bright, and his expression contented. Animals such as this one never attempt to escape or to bite, says Doctor McCollum

Here is a little bow-legged rat suffering from rickets caused by faulty diet. By experimenting with rats, Doctor McCollum is seeking the cause of rickets, a disease of malnutrition from which 50 to 75 per cent of all children in the world are said to suffer



The diet of these two animals of the same age was identical with the exception of the kind of fat they included. The large one received butter fat; the small one's food was made up with vegetable oil in its preparation

old rat whose senility was in striking contrast to the sleekness and virility of his neighbor in an adjoining cage.

"I suppose you are about to retire this one," I remarked, pointing to the gray rat. "He must be the ancestor of them all."

"On the contrary," said Doctor McCollum. "That young-looking rat is a year old and is the father of the ancient-looking rat, which is just four months old."

Here indeed was a striking example of what this remarkable scientist is accomplishing by means of diet!

Just now Doctor McCollum, with the cooperation of Dr. P. G. Shipley, is deeply engrossed in the study of bone growth, with particular reference to the prevalence of rickets. This disease of malnutrition is one of the tragedies of childhood. From 50 to 75 per cent of all children are declared to be afflicted, and for this reason a solution of its cause and prevention would become one of the master contributions of research to the human race. The work promises to take years, but the true scientist views such a prospect undismayed—and McCollum is the true scientist.

Some of his most important recent work has been along the line of the relationship of food to the kidneys, in an effort to determine what nutritive factors are involved

in the progressive loss of the kidney functions with advancing years. Results place the blame on what the scientist designates as high protein content of the diet, which the rest of the world understands as the eating of too much meat. In this research Doctor McCollum has brought to light much that is new and important.

Doctor McCollum will take a slice of steak, a dish of beans, or a ham sandwich and analyze it to the last atom of its possible effect on the human body. He can glance at the dinner table of his hostess and tell from the food spread before him precisely how much the meal offers in nourishment, energy, and well-being.

As a scientist he is exactness itself. But he does not believe in making the dinner a matter of multiplication and addition—a problem in mathematics.

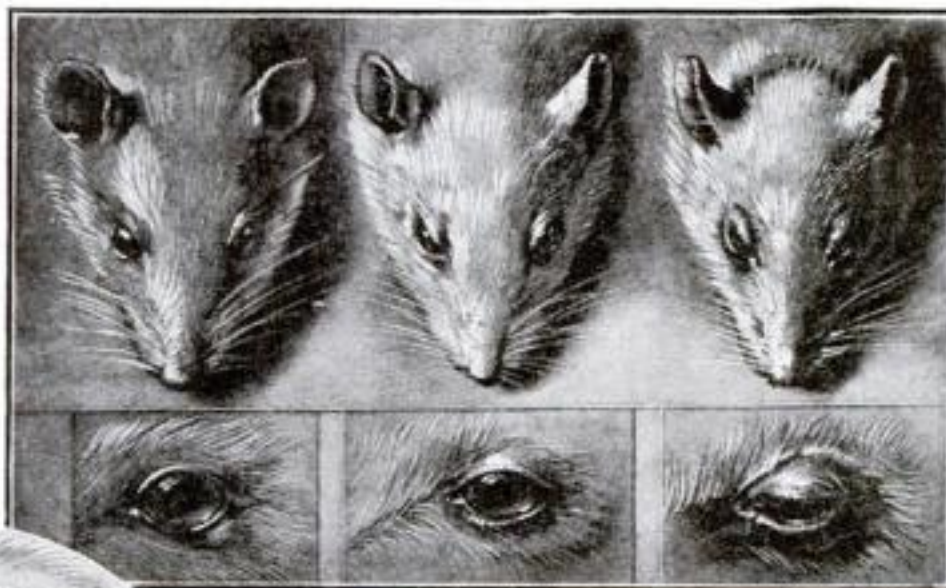
"It seems useless to me," he said, "to tell the housewife that she must give her family this number of calories and that percentage of various vitamins. It is unfair to expect her to figure that there are 500 calories in a certain steak, 400 in a given amount of liver and bacon, and 300 in a specified weight of spinach. To do this is to expect her to sit down with pencil and paper and figure out for herself by mathematical rule the various dishes that constitute a well-balanced bill of fare.

"In this connection I am convinced that the planning of the meals is of itself a task of which the housekeeper should be relieved by science, and for that reason I have tried to do the work in her stead. In that theory lies the explanation of my book, 'The American Home Diet,' prepared with the collaboration of my associate, Miss Nina Simmonds."

Yearly Bills of Fare

To do away with multiplication, subtraction, and long division in planning meals, Doctor McCollum has given the housewife a bill of fare for three meals a day for every day in the year. The important fact is that he has done all the mathematics in his own laboratory, with the assistance of his rats. These bills of fare are convincing. They show that a scientist may be a human being along with his intimate knowledge

of our digestive workshops. This is proved by the readiness with which he prescribes the things we like. His sole aim is to see that we eat these foods in proper proportions. The McCollum bill of fare is not a diet. It is simply a well-balanced ration, seeking to give the proper fuel to the human engine.



How the eyes are affected by insufficient food. The views at the left show the appearance of normal eyes in the rat. The middle views show the eyelids affected by a disease, due to lack of certain fatty foods. At the right are shown the swollen condition in late stages of the disease



This little fellow is showing the first symptoms of a nerve disease called polyneuritis, similar to beri-beri in man, produced by a diet deficient in certain vitamins. Note the tense attitude

Snow-Clad Peaks of the Moon's South Pole



THIS remarkable picture, based on actual astronomical photographs of the South Polar regions of the moon, indicates that the lunar poles, like those of the earth, are covered with snow. At least, that is the theory accepted by most astronomers in explanation of the fact that the poles of the moon are lighter in color than any other regions of its area.

Since the surface gravity of the moon is very weak, water cannot exist there in the liquid state; hence, the

inference that it is converted into hoarfrost, ice, and snow is natural.

The geographical position of the pole is marked by the majestic mountain range shown in the background, known as the Leibnitz Mountains. One rises to an altitude of 36,000 feet, or 7000 feet higher than the earth's loftiest mountain—Everest.

This picture is a photograph of a model of the moon's South Pole executed by Scriven Bolton, F.R.A.S.

Why Our Habits Make or Break Us

Another Illuminating Chapter in "The Story of the Mind"

By James J. Walsh, M.D., Sc.D.

ONE of the most significant stories I ever heard was told to me not long ago by a New England manufacturer.

A middle-aged man for several years had been a department head in the shoe factory where he had been employed since boyhood. A new concern offered him an opportunity to take charge of its factory at a generous salary, and he accepted.

His term of service at the plant where he had passed his entire working life came to an end on a Saturday night, and he was to assume his new duties the following Monday morning.

Force of Habit

When Monday morning came, the new manager, who, like most early risers, was accustomed to allow himself no more time than was necessary in getting from his bed to his work, hurried through his breakfast and rushed from his home to the street-car line just as he had been doing for years. The car he usually took was about to start from the corner as he approached. He caught it after a run, found a seat, and became absorbed in his newspaper.

Eventually he got off at a factory building, and hurried within. And not until he saw a stranger sitting at the desk that he had occupied for five years did he realize that, instead of going to his new position, he had walked straight into the



When deeply interested, Secretary of the Navy Edwin Denby, presses his tongue between his lips; a mannerism habitual to many persons when paying close attention

factory where he had worked all his life! Not only that, but the street car that had carried him there ran in a direction opposite to the one he should have taken.

Incredible though this story may seem, I find it entirely believable—an extreme case, perhaps, yet a wonderfully illuminating instance of the ruling power of habit in directing the activities of man. That factory manager was so accustomed to going to work at the same time and in the same way every morning that he unconsciously went through the same routine even after he had changed his place of employment.

You, Too!

We are all creatures of habit. You may not realize it, but most of the things you do are the creations of the habits you have formed. You are, in short, what your habits make you. Trivial matters, such as which shoe you put on first; more important things, such as the amount of sleep you take, the quantity of food you eat and the way you perform your work—all of these are the result of habit.

Through constant repetition you have so established a particular way of doing things that it has become entirely natural and instinctive, sometimes even involuntary and uncontrollable.

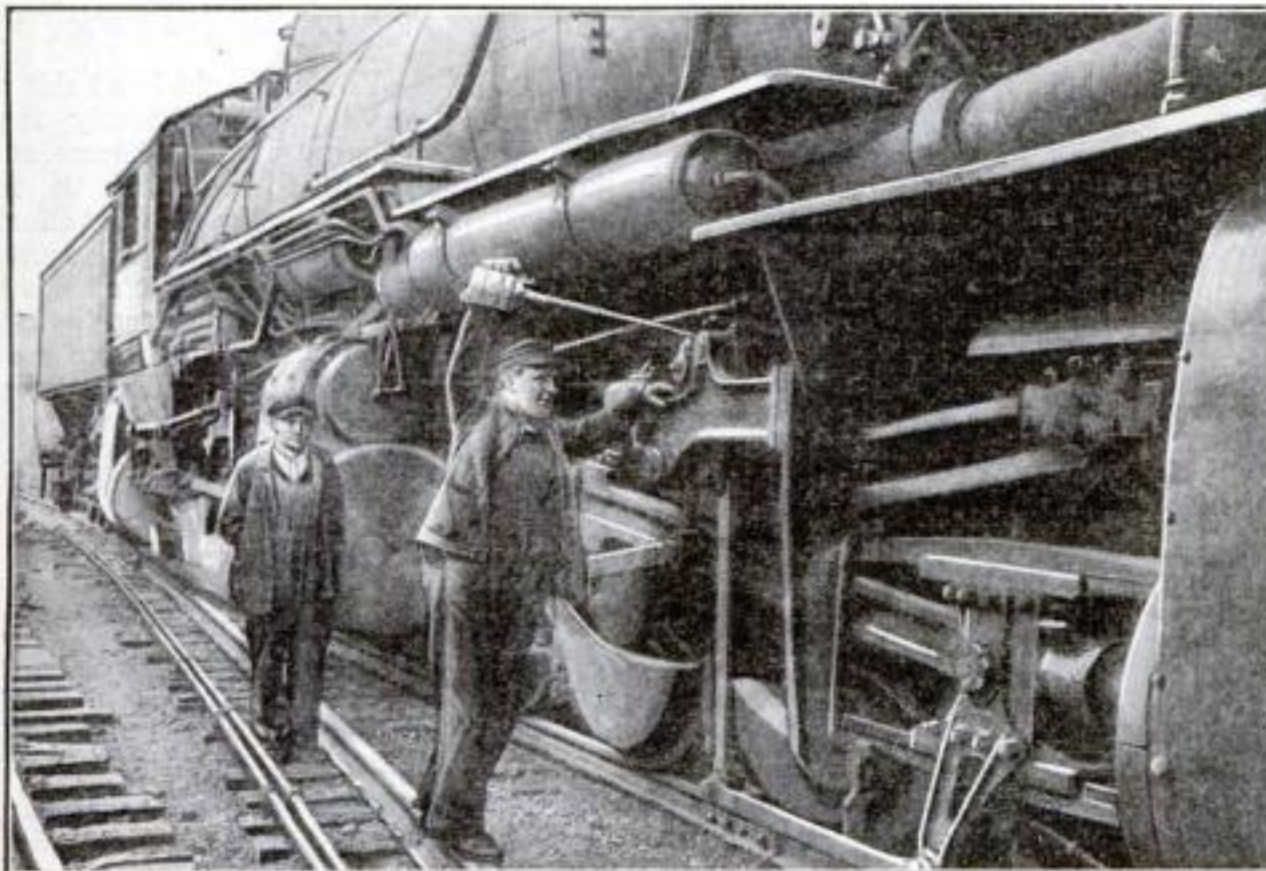
Constant repetition—that is the psychological explanation of habit. And while it is true that habits form your character, you, by constant repetition, can shape those habits for good or bad—for health, success, and happiness, or for failure and misery.

If you are driving a motor car and suddenly find it necessary to stop, you will apply your feet so swiftly to the clutch and brake pedals that your action seems instinctive. It is not instinctive, however. It is performed through habit—through constant repetition. When you first started driving, you will remember, you had to think of each of these movements separately and so performed them slowly.

"How Use Doth Breed a Habit"

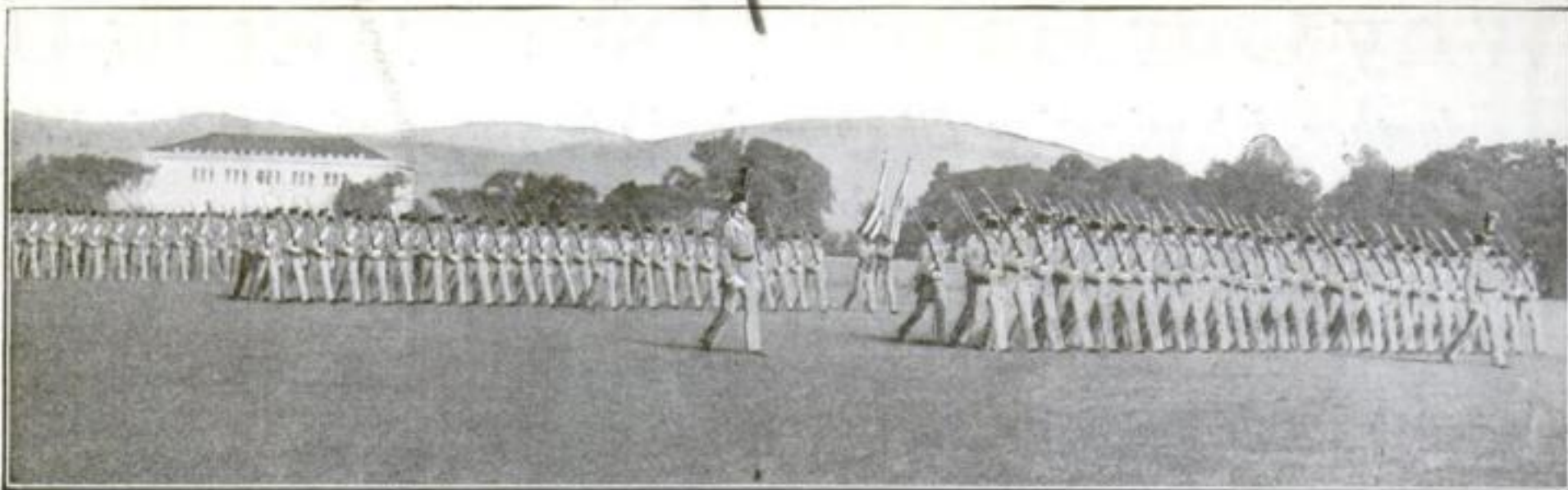
Even if you are not driving a car—are merely a passenger—habit may lead you to go through the motions of throwing out the clutch and putting on the brakes when the necessity arises for suddenly stopping. I know a motorist who was forced to give up long tours in the summer because of this habit of back seat driving. He always was as tired as his chauffeur at the end of the day's run.

Sometimes habits become so natural that without indulgence in them we feel ill at ease. I could name half a dozen men who actually cannot work unless they have a pipe or a cigar between their lips, even though they may not be smok-



The locomotive engineer has formed the habit of leaping from his cab and oiling the engine as soon as he reaches the end of his run. So

firmly is this habit rooted, that the action is performed involuntarily, apparently without conscious effort on the engineer's part



Marching and drilling with marvelous precision, the West Point Cadets are a striking example of the value of habit in successful achievement of the most exacting work. By constant repetition they have formed the habit of always stepping out with the left foot. It has become "second nature" for tall and short men to take steps of the same length to preserve alignment of the ranks. All rifles are held at the same angle. Small points such as

these that combine to make the parading companies march as a single, rhythmical unit, were learned at first by painstaking effort. With the trained cadet, they have become unconscious acts. Similarly, Doctor Walsh tells us, profitable habits of health and industry that promote success in any field of endeavor can become so deeply entrenched in us that we shall find it almost impossible to perform an injurious or wasteful act

ing. And I know a lecturer who thrusts his right hand into his trousers pocket the instant he takes the platform, keeping it there throughout his talk. He told me once he would stammer like a schoolboy if he couldn't have his hand in its accustomed place.

What Are Your Habits?

Any number of public speakers have habits of interpolating a syllable like "aa" or saying "ugh" or something of that kind, and when they attempt to break themselves of it, they actually disturb their thinking and their speech. Such is the force of habit.

Such habits in themselves are trivial things perhaps, but they have an important bearing on our daily actions. If you work in a shop or large office, you will observe that every one of your fellow workers starts the day's work and precedes each new task invariably with certain characteristic mannerisms. You yourself undoubtedly traverse the same path every day on your way to your street car, railroad train and office, walking always on the same side of the street, making your crossings at the same points. If you drive an automobile, it is almost certain that you always use the same roads or streets in traveling between two points, even though you may have a choice of other roads equally good. Unless you are unlike most other people, in chewing your food you use the teeth of one side of your mouth much more than those of the other.

Every one of these acquired habits is the result of repetition. The first time you perform an action, you find it difficult. You are awkward, and so it is necessary for you to consider each separate movement carefully before you make it. Each step is accompanied by a rapid-fire, more or less disordered interchange of nerve messages between your senses, your brain, and your muscles. The second time you perform the action, you find it a little

easier. There is the same interchange of nerve messages, but it is accomplished more smoothly; you have found out what lines in your bodily telephone system must be kept open for the exchange of messages, and you prevent interference from unnecessary calls.

The third time you essay the action, it is even more easy; the nerve messages travel back and forth with greater speed and surety; the necessity for attention is less. And, when you have done the thing a few more times, the exchange of messages is accomplished automatically, without conscious effort on your part. The action has become a habit—"second nature," as the phenomenon often is expressed. This is a particularly happy way of expressing it, too, in my opinion,

since nature so often takes care of us when we cannot take care of ourselves. Our habits—which depend entirely on ourselves—will take care of us if we see to it that they are of the right kind when we are forming them.

It is unfortunate that when habits are mentioned, most people think of bad habits, just as when we talk about passions, people conclude that evil passions are meant. As a matter of fact, every normal person possesses passions for good so strong that if he follows his natural inclinations, he finds it easier and much more satisfactory to do right than to do wrong.

These passions for good are ingrained in us. They are part of the inheritance of the race, evidence of a world force that makes for good.

Similarly with habits. Habits for good can be so strong that we will find it all but impossible to break away from them and perform an evil action. I do not mean "evil" in a moral sense necessarily. What I mean is this:

Training Yourself

You can make it a habit to work so industriously that idleness will be irksome and painful to you, with the result that your constant efforts will carry you on to success.

You can make it a habit to eat plain, wholesome food, to chew it thoroughly, to exercise, to bathe frequently, to breathe fresh air and get plenty of sleep, and thereby insure your health.

You can make it a habit to be thrifty and frugal, and so prevent the specter of want from hovering above you in old age.

All of these habits you can acquire through your own efforts and only through your own efforts. Moreover, because your body falls so readily and rapidly into modes of action that become habitual when repeated, the effort required will be less and less as



Is it your habit always to point with your right hand? You could point with your left hand just as well, but you would not do so unconsciously, as you do with your right through constant repetition

time goes on. In fact, it is necessary to do no more than to make a good start. After that, Nature carries on the work for you, and at last the habit is ruler and can be broken only by a determined effort.

No principle more useful than this has been developed by the science of psychology. I might almost say that once a man understands the ruling power of habit, he has learned everything of practical value that psychology offers him; that he holds in his hand the key that will unlock the storehouse containing the hidden powers of his mind. For when he reaches the point where habit performs most of his daily routine of activities, his mind is left free to occupy itself with the other more important concerns that will lead him on to greater achievements.

Habit and Instinct

A simple illustration will serve to make clear how habit takes the place of instinct, how it causes the body to perform an action without our being conscious of the guidance of the mind. Undoubtedly there is a flight of steps in your home that you have walked up and down many times. Unless your habit of observation is unusually well developed, you cannot tell me how many steps it contains. Yet you can ascend and descend it in the dark and never fail to know when you are about to step to the upper or lower landing. I do not mean that you can *feel* the landing when your foot touches it, but that, when you reach the last step, you know—seemingly by instinct—that you are about to step from the stairway.

This is not instinct, though; it is the result of habit. Although you cannot state the precise number of steps in the stairway, your mind knows from previous experience exactly how many there are, and so accurately guides your muscles in carrying you up or down. It is possible even for you to carry on a conversation with some one while walking up a familiar flight of stairs in the dark, and, though you may be giving full attention to your talk, habit will guide you safely to the top.

A few minutes after you have gone to bed at night you cannot recall having wound your watch, yet, if it is your habit to do so upon retiring, it is almost certain that you will find you have done so if you get up to investigate.

Example of the

strength with which habits take hold and the difficulty with which they are broken is furnished to all of us who live in places where "daylight saving" is put in force during the summer. When the period begins, we suffer acute hardship getting up an hour earlier in the morning, and we

never will notice these sounds unless their attention is specifically called to them. All of these are examples of the amazing force of habit.

Take pencil and paper and try to copy a simple drawing, say the head of one of the characters in a newspaper comic strip.

You find it difficult, even if you have had some practice in drawing. You must stop again and again to refer from the model to your drawing. Yet you can write a long letter without ever giving a thought to the manual dexterity required in forming the letters, which are quite as complicated as the lines that make up a single comic drawing. Habit is the explanation.

Marks of Individuality

The acquisition of a habit may be compared with the uncomfortable process known as "breaking in" a new pair of shoes. It is painful at first, but there comes a time when the habit, like the shoes, becomes set to our conformation. Like old shoes, we wear the habit without ever being aware that we have it on.

Habits actually become so much a part of an individual that in the case of well-known men the habit often is an identifying mark, quite as much as are facial and other physical characteristics. "Uncle Joe" Cannon, late Speaker of the House of Representatives, had the habit of smoking long cigars. Through thousands of photographs and cartoons published during

his long public career, this habit was so well exploited that most people probably would have failed to recognize a likeness of him without the inevitable cigar.

Everybody knows that the enormous amount of work Edison has accomplished is traceable largely to the habit he acquired early in life of getting along with very little sleep. When Clemenceau, the "Tiger of France," visited the United States a few years ago, the reason for his marvelous vigor at an advanced age was revealed in his regular and abstemious habits.

Woodrow Wilson His Own Typist

While Woodrow Wilson was President, his custom of writing important speeches and documents in shorthand or on his own typewriter was commented on frequently. Though he had secretarial and stenographic aid at his call, nevertheless the habit of years persisted—he thought most clearly when he himself performed the mechanical work incidental to composition.

The late Professor William James, noted psychologist of Harvard University, likened a habit to a groove in the nervous system, down which impulses flow, making the groove ever deeper so that the im-

(Continued on page 152)



This chemist is typical of the man who finds it quite impossible to do his best work unless he has a pipe or cigar between his lips. He probably is quite unconscious of the fact that he is pulling on his pipe. His whole attention is concentrated on his experiment; yet habit causes him to perform all the actions incidental to smoking. How many times have you caught yourself pulling on a cold pipe?

find it difficult to go to sleep immediately when we go to bed. When it ends, we find ourselves for a time waking up too early in the morning and becoming drowsy at night before what, according to the clock, is our bedtime.

Change of environment likewise upsets our habitual routine. People who do little traveling are restless in hotel beds or sleeping-car berths, while experienced travelers sleep peacefully, no matter what their changed environment may be.

City dwellers are not aware that they hear the rumble of traffic and the roar of street cars—sounds that are all but agonizing to the visitor from the country. Similarly, city people are acutely aware of the noises made by insects and animals, the rustle of trees and similar sounds peculiar to the rural districts, while country people



Through habit, the experienced telephone switchboard operator reaches instantly for the right plug when she hears a certain number or name in the telephone receiver.

Mechanics, My Aid in the Wilds

By Captain Frank Hurley

World Famous Explorer, Discoverer of the Lost Tribe of New Guinea

IN THE imaginative hours of impetuous childhood, who has not been fired with the soul-stirring desire to become a carefree buccaneer?

Thus it was in my early life, even though the years were wrought in the hard school of iron, and tempered by poverty.

To gain a sound fundamental knowledge of mechanics, to be master of metal, this was to be my chosen occupation. So for five years I labored, the day at the lathe, the evening at college. Later I devoted four arduous years to the study of photography. Little did I ever imagine that the wild fancies of childhood ultimately would rise supreme and subvert my engineering plans for the future.

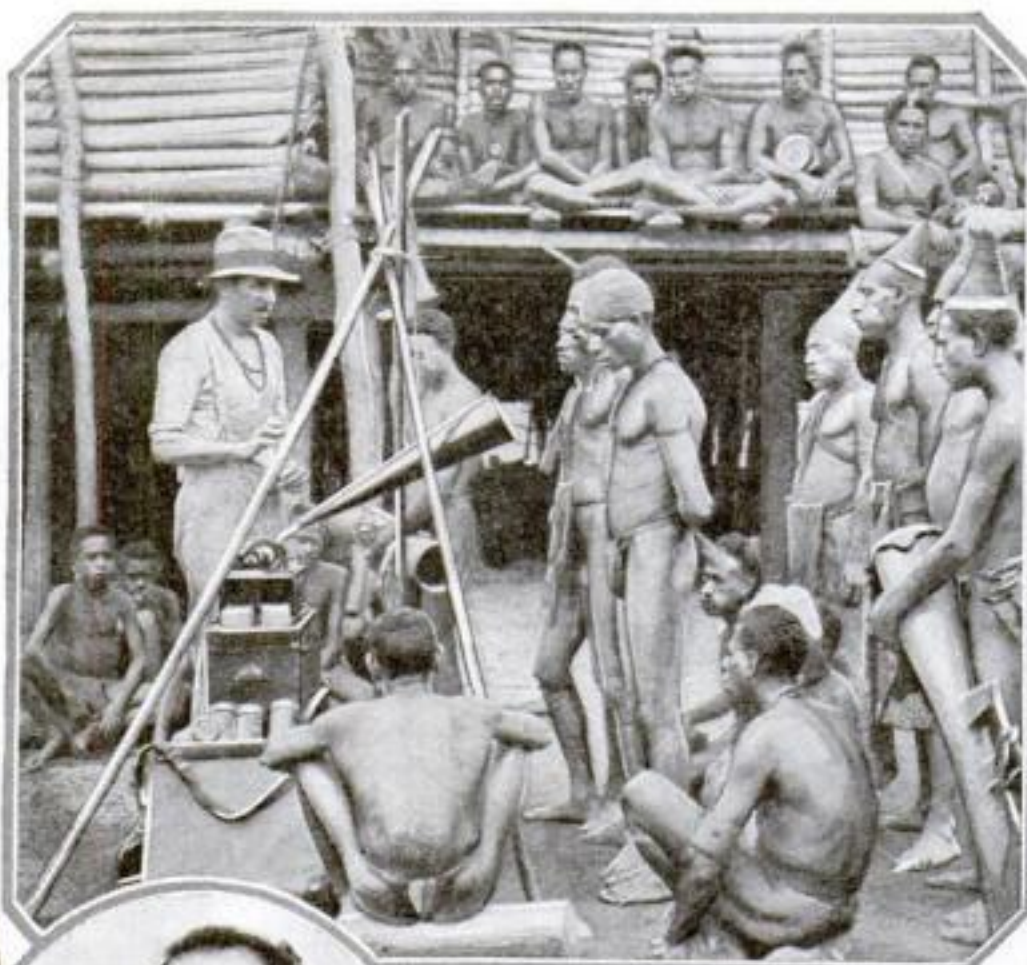
An Opportunity

Yet what a dominant part those years of practical application were to play in the ultimate success of the many hazardous enterprises upon which my primitive romancings launched me!

The golden opportunity came while Sir Douglas Mawson was manning an Australian expedition to explore the antarctic regions, and every shoulder that carried a camera joined in competition. Though the chances were at least 1000 to one against me, I was chosen simply because I had photographic skill and a solid backing of practical mechanics.

When I turned southward to the regions of eternal ice, my chest of tools included as careful and complete a selection as my battery of lenses. The expedition's personnel was chosen from the "Don" graduates of Australian universities, highly trained in theory—men to the core—but in mechanical practice quite deficient. I shall never forget the rude yet amusing experiences of those first antarctic days when the scientists unscientifically erected our winter quarters hut.

I remember Dr. Xavier Mertz, ice expert, sitting straddlewise the ridge cap, enthusiastically banging at nail heads, but more often hitting his finger nails. Inside the house the learned bacteriologist, Dr. Archie McLean, with equal ardor, was



Science and art meet in the jungle. Captain Hurley is shown above making phonograph records of primitive native songs of the "lost tribe" in New Guinea. A theme from one of these weird chants has been elaborated into a "jazz" tune to be published soon. Note the strange musical instrument held by the savage head-hunter at the extreme right

At the left is Captain Hurley, fearless explorer, holding a boomerang that he brought back with him from his explorations in New Guinea

He Made His Own Way

"**F**IND a way, or make one!" is Capt. Frank Hurley's apt summing up of the secret of achievement—advice based on the experiences of his own remarkable career of adventure.

Twenty years ago a poor boy in Australia, he has made his way successively as machinist, engineer, photographer, war hero, explorer, and writer. Now, at the age of 34, he finds the eyes of the whole world focused on him as a result of his discovery of a lost savage tribe in the jungles of New Guinea, territory never previously explored by a white man.

Captain Hurley was official photographer to the late Sir Ernest Shackleton's South Polar expedition. He has taken part in other polar explorations and is now planning another trip into the antarctic. He has explored Australia's unknown territory by automobile, being possibly the first man to use a motor car in prosecuting an exploration.

His own story of how his mechanical skill, acquired in boyhood, carried him safely through the most desperate situations, is an inspiring chronicle, bound to stir the blood and to stimulate the spirit of every lover of adventure.

tacking on the light ceiling boards directly underneath, using four-inch nails. A wild yell and Mertz leaped, slid precipitately down the sloping roof, clutched wildly at the stay supporting the kitchen chimney, and dove headlong into a snow bank carrying the smoking stack with him. Closer investigation of the cause disclosed an inch of piercing nail bristling through the roof from whence the punctured Mertz had so hurriedly risen.

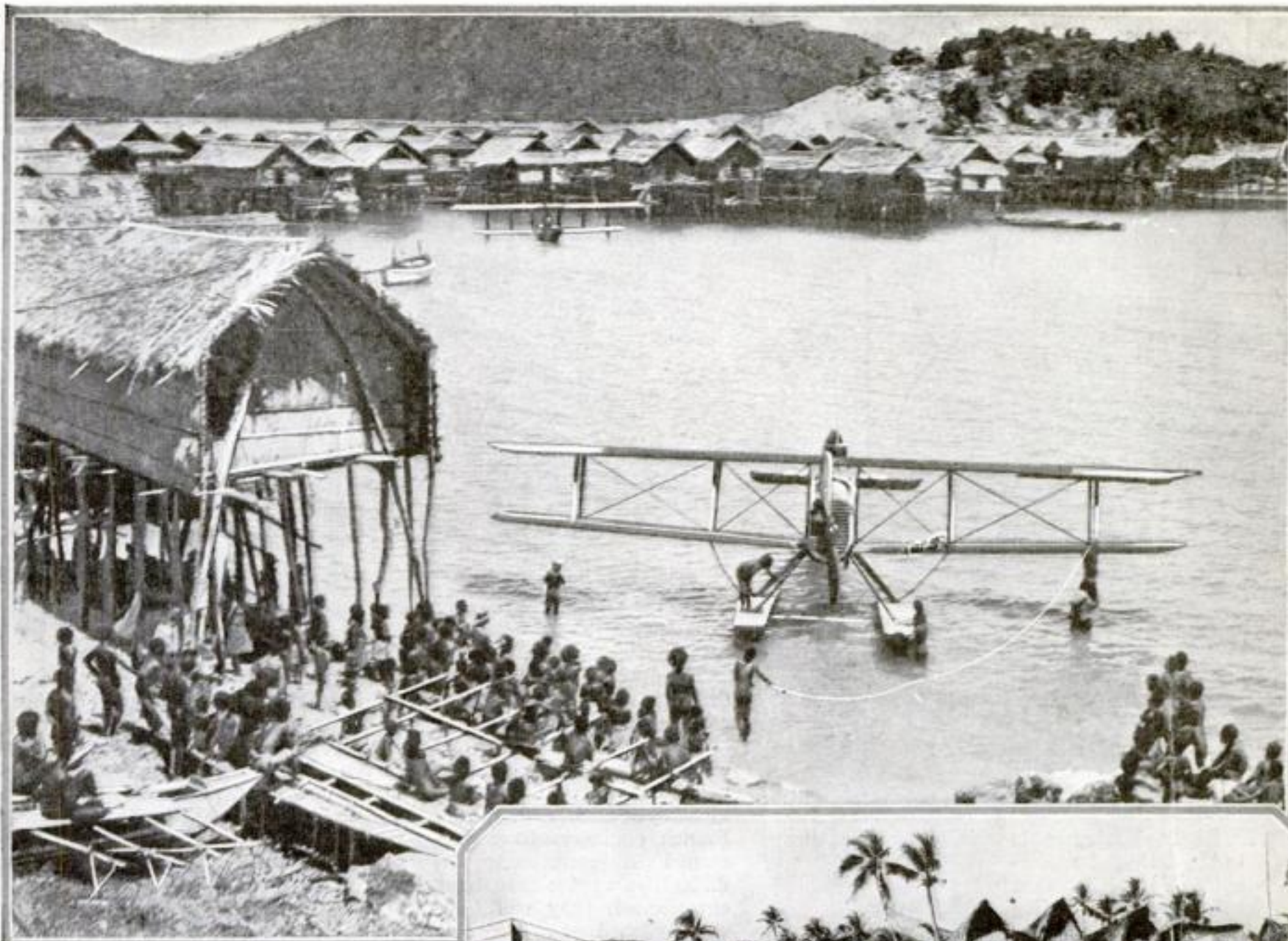
Antarctic Inventions

Cut off from the world for more than a year, we were thrown entirely on our own devices and resources. The frigid conditions necessitated alterations in my cameras and the making of special developing appliances with warm-water circulators. In addition, various scientific instruments and wireless equipment demanded ceaseless attention, so the mechanic became a very important man. I even added to the expedition's store of scientific apparatus by fashioning from odds and ends various instruments for meteorological observation.

One of these I called the "blizzard detector." It consisted of a metal ball mounted on a mast above our hut, insulated from the ground and connected with a simple gold leaf electroscope inside the hut. Atmospheric electricity generated by a snowfall was taken up by the ball and traveled to the electroscope, which was connected through a relay with an electric bell circuit. When the electroscope was charged, its movement closed the circuit that operated the bell, and the snow alarm rang out. This contrivance proved most efficient, so much so that one of the party, after being awakened by it a half-dozen times one snowy night, hurled a boot at it and finished it.

Alarm Clock Wind Detector

I also made a machine for detecting the velocity of the wind, which averaged 49.9 miles an hour during our stay, reaching at one time a velocity of 214 miles. An alarm clock served as the basis of this instrument. The hour hand of the clock caused a dial of smoked paper to describe a complete revolution once a day. Against this dial was placed a pointer, balanced by a spring and connected



The explorers' two seaplanes, landing where neither white man nor his winged machines ever had been seen, filled the New Guinea head-hunters with superstitious awe. After much persuasion they were induced to approach the planes

with a celluloid ball, hung on a long horizontal wire. As the wind moved this ball, the movement was transmitted along the wire to the pointer, which scratched the smoked surface of the dial. Photographs of the curves scratched on the dials supplied us with accurate wind records.

More for amusement than anything else, I constructed a sled driven by a wind motor. A wind wheel mounted on a turret turned through a system of worm gearing two spiked wheels beside the runners. As the spikes sank in the snow, the sled moved forward. By setting the fan according to the direction of the wind, it was possible to steer the sled, to travel with the wind, against it, or at an angle to its force.

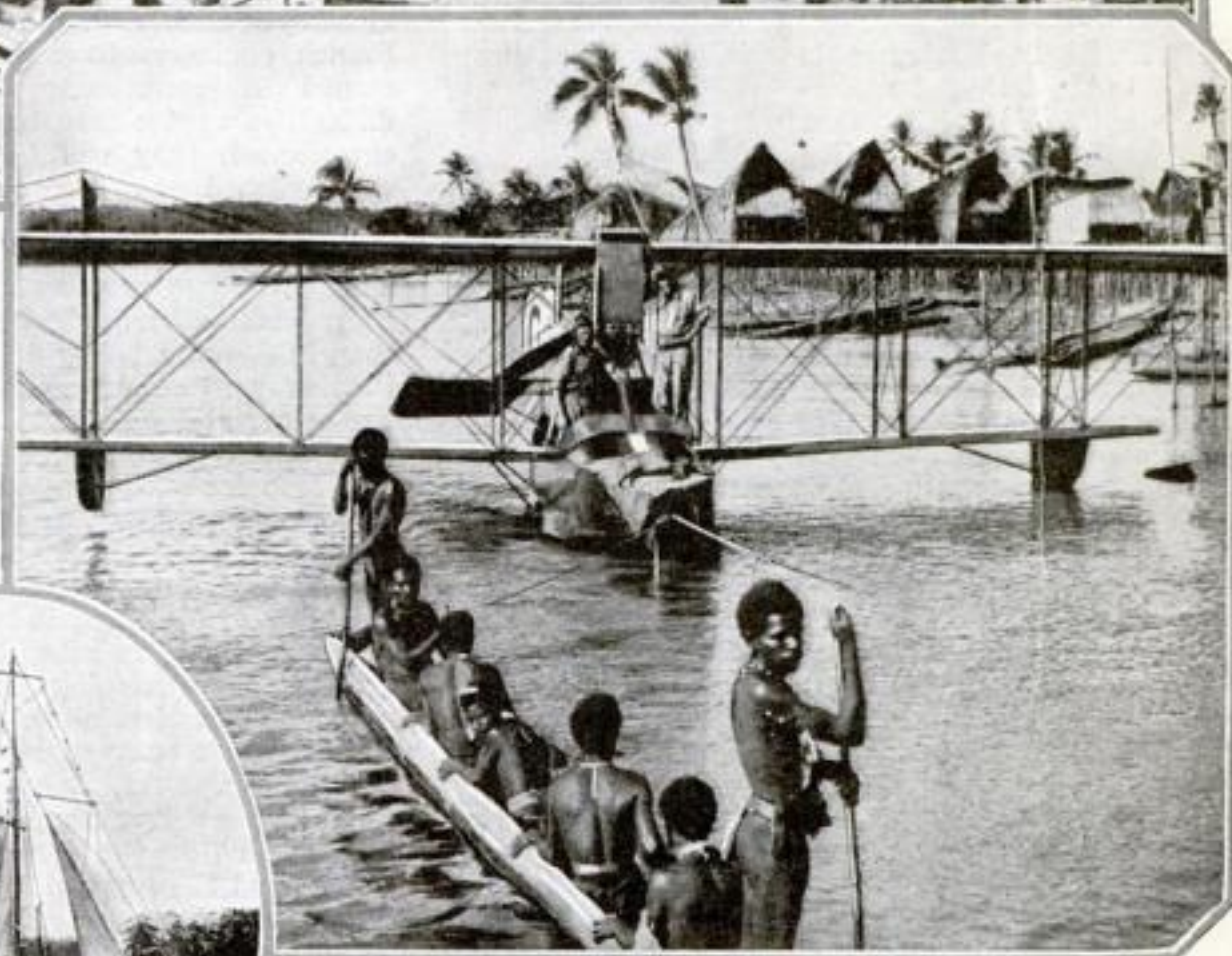
The manufacture of these devices gave me my first experience in utilizing scraps for the fashioning of useful articles, an experience that proved invaluable on later expeditions, for it literally saved my own life and the lives of others and carried my companions and me safely through several dangerous emergencies.

The Mawson expedition paved the way

to others—the East Indies, a second antarctic cruise and finally a small venture of my own, when I joined forces with Francis Birtles, another Australian explorer. In two "flivvers" we left Sydney on a 10,000-mile "joy ride" through Australia's unknown, venturing on wheels among the primitive aborigines. Had it

not been for our mechanical initiative—Birtles had also served his time in iron—the journey never could have been accomplished. Little other than the essential working parts of the "flivvers" remained upon our return, and these displayed many crude thermite weldings, and

(Continued on page 153)



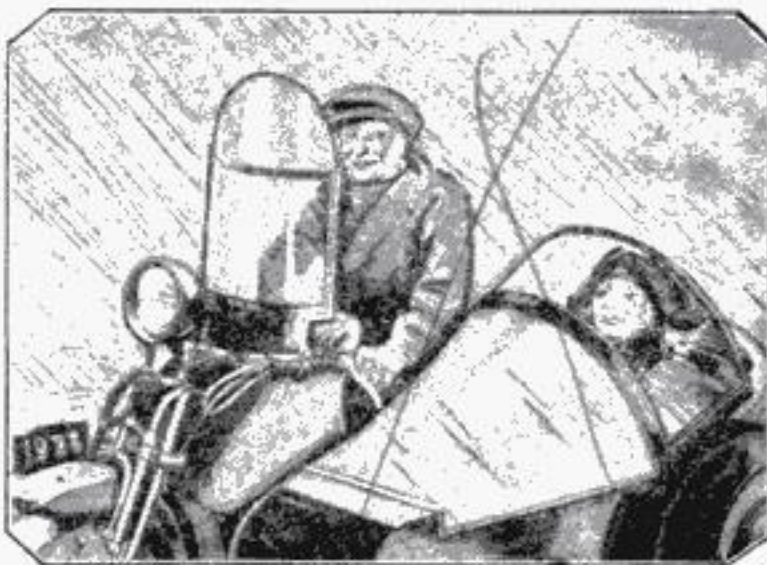
The natives believed the white men were gods and their aircraft huge voracious birds that would attack them unless appeased. Each night, as the flying boats lay at anchor, the savage head-hunters brought pigs to satisfy the appetites of the terrifying visitors from the skies. One of the pigs is shown above lying across the bow of the plane. The explorers were careful to remove the pig before morning, so that the natives would believe the winged monster had devoured it. At the left is the light draft vessel used by Captain Hurley as a seaplane tender. Its wireless equipment guided the planes in their explorations over the jungles and made possible speedy location of the machines

New Motorcycle Comforts

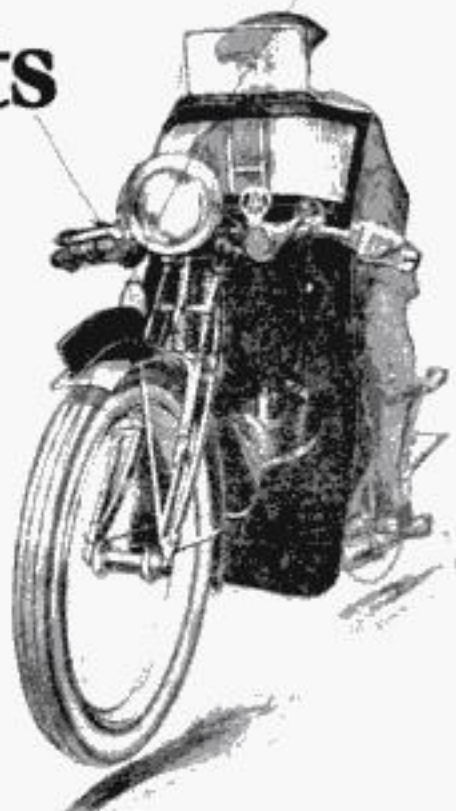
All-Weather Shields Protect Riders Snugly



Face and body shields for the driver; side curtains and top for the sidecar give protection to the riders in stormy weather



Rain, wind, or snow hold fewer discomforts for motorcycle riders with the development of ingenious shielding devices that are transforming the breezy cycle and sidecar into a comfortable, all-weather vehicle



This apron, attached to the frame, is surmounted by a celluloid window and face shield

By Newton Burke

RECENT developments in the design of motorcycles indicate that the problem of protecting riders from the wind, rain, and snow of winter—a problem that has engaged the attention of designers since the use of the machines became general—is about to be solved.

The sidecar already has been made snug and weather-proof. Now the comfort of the man in the saddle is being provided for.

American engineers are watching with interest a new development that is expected to do much toward making the motorcycle an all-weather conveyance. This is a design by French engineers that would inclose the rider in a cab, providing freedom of movement and clearness of vision without the usual exposure to the weather.

Light Frame Holds Hinged Top

A light metal frame, streamlined, would be attached to the frame of the motorcycle in such fashion that the handlebars and front wheel could be turned at any angle within the body. A large celluloid window would give the driver clear vision, at the same time extending far enough above his head to deflect all wind and rain beating from the front.

Should rain come at such an angle that it would strike him in the back, he could unfold a hinged top that would fasten to the frame and cover him, thus inclosing him in a cab. The sides then would be left partly open to allow arm signals. Wide, curved leg shields would protect the rider from beneath, and side plates would cover the engine. A slight extension of the exhaust would permit gases to pass out from the inclosure.



One of the first face guards—an apron belted about the driver's waist, supplemented by a celluloid window extending to the top of his head

The practicability of such a design is conceded by American engineers.

"There is absolutely no reason why such a shield cannot be designed," said one motorcycle authority. "If the French engineers have succeeded in overcoming the difficulties that others have experienced, they will have accomplished an improvement that should find considerable use, especially in Europe, where the motorcycle finds wider application than in America. Any practical device that will add to the comfort of a motorcycle rider will be welcomed where motorcycles are used for service as well as for sport."

While the design of the French engineers is radical in that it proposes to inclose the whole body of the rider, it follows along the recent advances made by American engineers in developing protective devices. The first of these was a top and side shield that converted the sidecar into a closed cab. Next, designers undertook to protect the driver from rain and mud by shoe and leg guards, some types of which covered the legs entirely. But this left the face without protection.

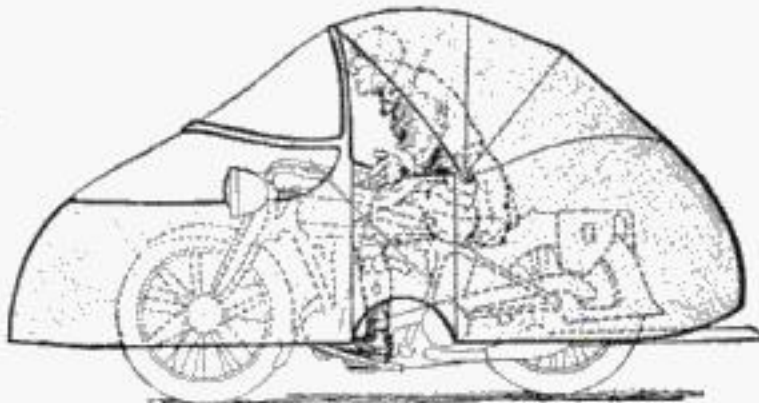
One early and effective face guard was an apron belted about the waist of the driver and with a celluloid shield extending upward to the top of the driver's

head. It was held at a comfortable distance from the face by arms extending from shoulder straps. The apron curved slightly, to reduce wind resistance, and served to keep water from running down on the cyclist's trousers.

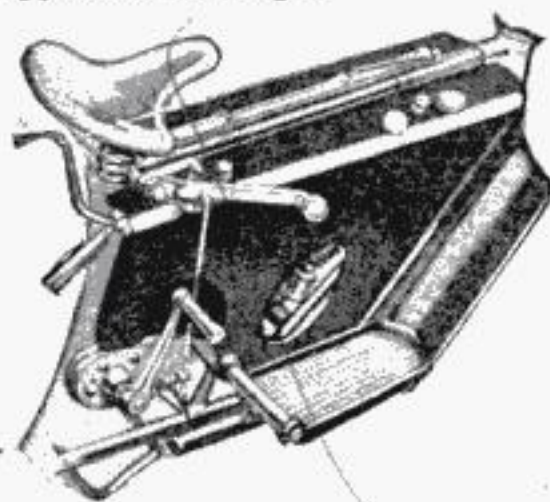
Another shield fastens to the frame of the machine. An apron extends downward from the handlebars to a point below the level of the wheel hub, protecting the legs from splashed mud and water. The upper portion above the handlebars has a curved window of celluloid. Above this is mounted a movable window to which may be fastened an automobile windshield wiper. Since this shield is curved and tilted slightly back toward the cyclist, the wind resistance is practically negligible. The protective device is attached to the frame in such a way as to avoid any interference with the control and operation of the machine.

Motorcycle Development Is Rapid

The transformation of the motorcycle from a motorized bicycle to the highly efficient vehicle has been rapid, from a mechanical viewpoint; but in the matter of comfort for the driver and passenger the advance has not been so marked. However, with engineers here and abroad working on the problem, the transformation of the breezy, two-wheeled speedster into a comfortable, all-weather conveyance appears to be in sight.



The new French design for converting the motorcycle into a cab. A streamlined metal frame supports a hinged hood that can be lowered about the rider



Leg guards and a protective shield for the motor are improvements in weatherproofing

Are You a Physical Spendthrift?

Science Explains the Tired Business Man; Overtaxed Bodies Go Bankrupt

By Reynold A. Spaeth, Ph.D.

Associate Professor of Physiology,
School of Hygiene and Public Health,
Johns Hopkins University

SOME people seem to be born tired. Yet we may assume that the average adult starts in to work in a normal, rested condition. He begins his career with a sort of capital, a physiological capital, which he can spend recklessly or carefully just as if it were capital in the form of money.

When a man works, he draws on his physiological capital; when he rests and eats, his account is balanced, his energy is restored. Normally, we go through life alternately spending and saving. The harder we work the more physiological capital we spend and the more we have to rest to balance our physiological account. The man who overworks continuously with little rest is a spendthrift. Sooner or later he becomes physiologically bankrupt.

Now the fatigue produced by any specific job, say lifting five-pound packages from the floor to a shelf, depends not only on the weight to be raised, but also on the rate at which the work is done. If I lift two five-pound packages a minute, I can stay on the job almost indefinitely; but if I have to lift 20 packages a minute, I peter out in a relatively short time.

Ration Out Rest and Work

At two packages a minute I am constantly returning to my original level of physiological capital; at 20 a minute I cannot rest enough between packages to hold the pace. In other words, for any unit of work there is a corresponding time-unit of rest that will exactly and completely restore the muscles to their original working level. It is failure to regulate work to this proper speed that causes undue fatigue.

An expert bricklayer who has found his stride can lay a given amount of bricks each day without being fatigued in the evening. But let him try to hurry the job and what happens? For the first few hours he may do much more work than usual, but along in the afternoon he begins to get tired and his work slows up. By evening he has become so much slower that the net result of his day's work probably will be that he has accomplished less and is more tired than on ordinary days. His work-rest relation has been upset and his working capacity impaired.

Conquering exhaustion by the deep-seated urge for self-preservation, Alain J. Gerbault, French sportsman, recently crossed the Atlantic Ocean alone in a 30-foot sailboat, completing the voyage in 142 days. He is shown above in his

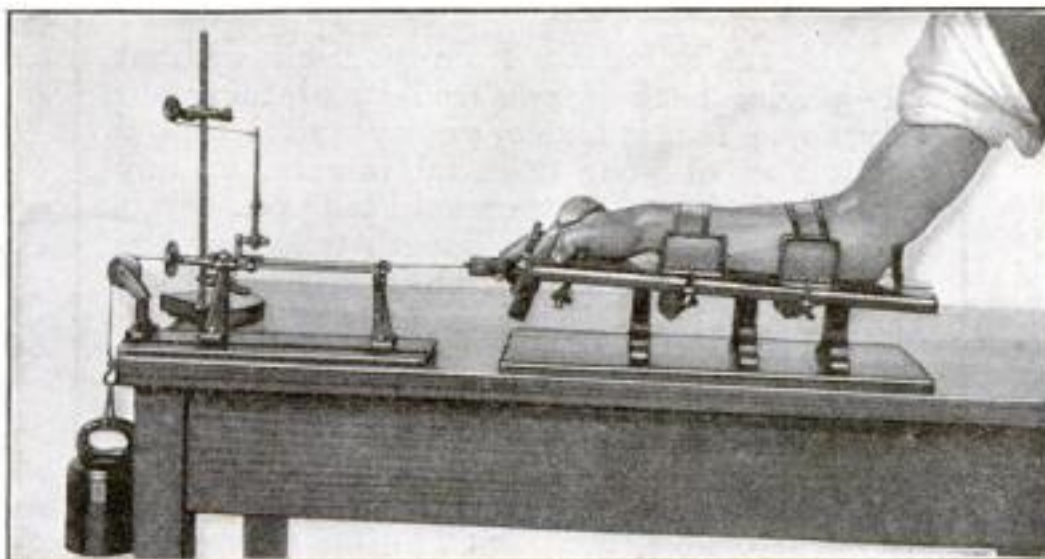
boat at the end of his record-making trip. His achievement is a striking example of how all of us, under the stress of necessity, can tap unsuspected resources of energy to perform surprising feats. For him collapse meant death

The heart is probably the best illustration of this work-rest relation. Between beats the heart rests just enough to prepare for the beat that is to follow and to overcome the fatigue of the previous beat. Through centuries of trial and error, the heart finally has settled to a rate of work that keeps it going for from 70 to 100 years. It never gets bored with its work.

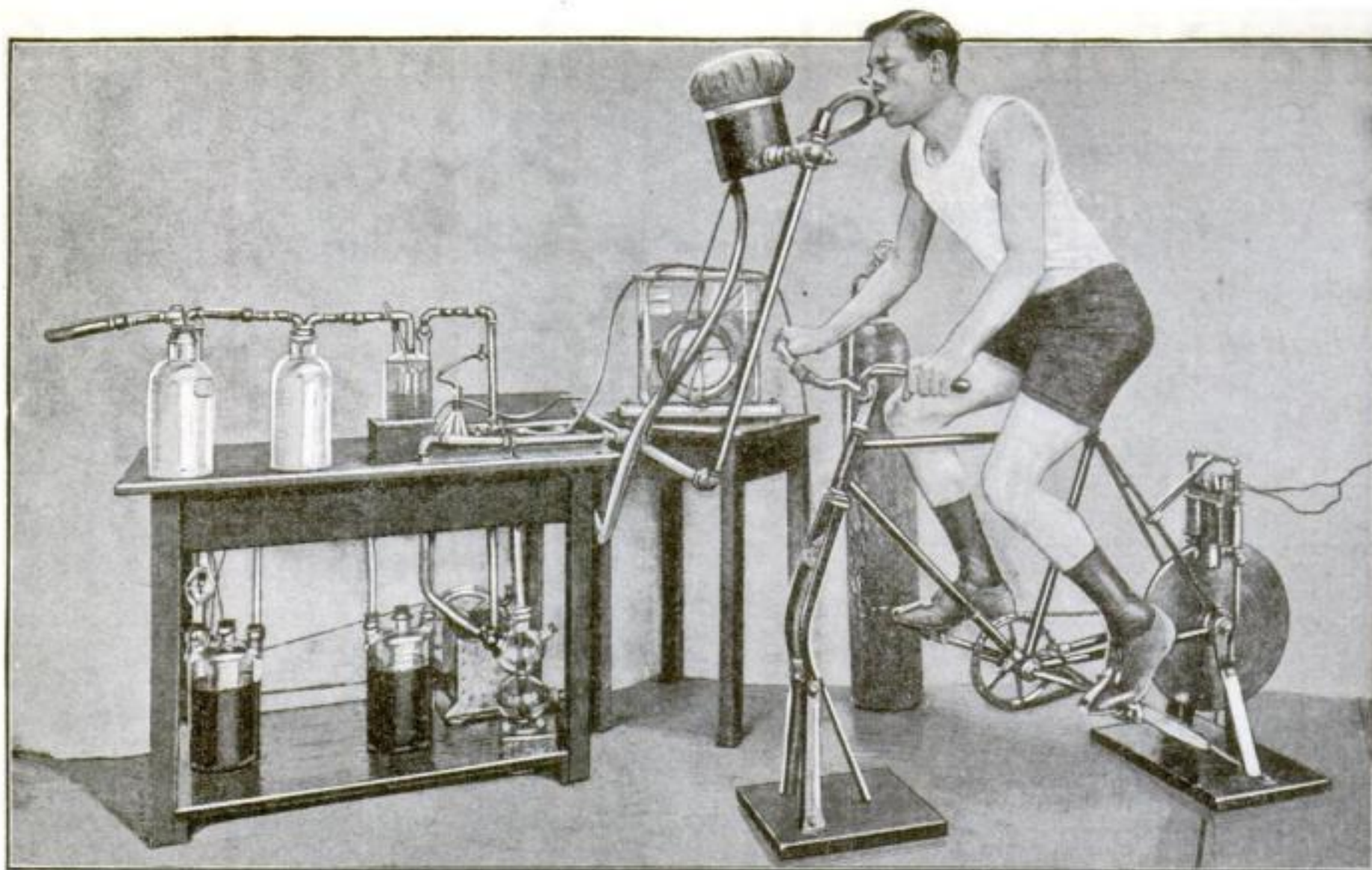
The entire human being, in contrast to the heart, is anything but a machine. Man is a willing or an unwilling, a hating, desiring, pleasure-seeking animal. We cannot set him going like a machine, knowing that he will still be running when we return. We must urge him artificially, by various incentives, to stick to his job.

In heavy manual labor, rest periods are particularly effective in protecting men against undue fatigue. But even in work that is merely monotonous or exacting, rest periods may do wonders. In an experiment that I carried out on a group of skirt pressers, two rest periods of five minutes each at 10 a.m. and 3 p.m. gave an average increase in production of more than 20 per cent. No physiological theory of calory consumption could account for such an astounding increase in efficiency. The effect was obviously psychological.

We might suppose that a man's working capacity is a stationary thing; that under any and all circumstances he is able to do the same amount of work, provided only that he has enough rest. This certainly is not true. We all know that under the stress of emotional stimulation we may perform really astonishing physical feats. The man who is chased by a bull and scales a fence at the other end of the field probably could not repeat his performance without the bull's help. After assassinating Lincoln, Booth broke his leg, but he was able, none the less, to drag himself to his horse and escape. Excitement and the deep-seated urge for self-preservation made available sources of



The ergograph—an apparatus used by Doctor Spaeth in his laboratory at Johns Hopkins University to measure the amount of work performed by students and to test their fatigue. The work consists of lifting an eight-pound weight with one finger at stated intervals, with prearranged rest periods



This strange apparatus is employed at the Carnegie laboratory in Boston, Mass., in experiments to measure the physical energy expended in performing any specified amount of work. Here the work consists of pedaling a friction wheel of a specified load. As he pedals, the rider exhales through his mouth into a tube that carries his breath to experimental test tubes and retorts. Meanwhile his

nostrils are closed tightly by pincers to prevent escape of his breath into the air. The amount of carbon dioxide he exhales determines the amount of energy he consumes in the work. Since the work and the exhalations both are measured accurately, the relation of one to the other is a measurement of the rider's physical fatigue. It determines the amount of work required to exhaust this bodily energy

energy that ordinarily he could never have tapped.

Alain J. Gerbault, a French sportsman, who recently crossed the Atlantic Ocean alone in a 30-foot boat, making the trip in 142 days, rather remarkably demonstrated this. At times, according to his own story, he was almost exhausted from lack of food and sleep, but to collapse would have meant death. Therefore, under the force of necessity, he tapped sources of energy he had never called upon before and managed to pull through. On his arrival in the United States he spent 18 hours in bed and then apparently was as fresh as ever.

Consider how you yourself respond to music. If the orchestra is good and especially if you enjoy the rhythm of the tune, you will dance far into the morning without unpleasant consequences. If you had to spend the same amount of energy removing ashes from the furnace or darning socks, the job would seem interminable. Work measured by ordinary performance gives us no idea whatever of what we might accomplish if only the incentive were strong enough.

The Human Engine

It has long been known that the energy consumed in muscular work is derived mainly from carbohydrates (starches and sugar), stored in the form of glycogen in the liver. Normally this fuel, in the form of sugar, is released into the blood in small

amounts, carried to the muscles and there burned up much in the manner of an automatic fuel furnace.

Professor W. B. Cannon, of Harvard University, and his students found that under the stress of excitement or emotion there is set free in the blood a secretion from a pair of small glands near the kidneys (the adrenal bodies), which speeds up the sugar-releasing machinery of the liver and enables all of us, under stress, to accomplish surprising feats.

Excitement, fear, pain, or rage, all set the sugar machinery going. If the emotional disturbance is a false alarm, calling for no muscular activity, the excess sugar is excreted in the urine and the normal sugar balance is restored. Doctor Cannon

once tested the urine of a number of substitutes who sat on the side lines at a Harvard-Yale game. Five of these men showed sugar. Merely watching the game and anticipating taking part in it was enough to set the physiological preparedness machinery in motion. An excited spectator who was examined also gave a positive sugar test.

Excitement does more than affect merely the sugar supply to the muscles. Through the stimulation of the sympathetic portion of the involuntary nervous system, the pulse is quickened, the blood pressure rises, and there is a redistribution of blood from the stomach and intestines to the arms and legs, where the muscular work of fleeing or fighting is concentrated. Thus all the physiological changes that accompany excitement are preparation for sudden and intense action.

The value of such changes to an animal in its struggle for existence are obvious. The value to human beings becomes evident when we consider that even for civilized man emergencies arise that can be met only by terrific bursts of physical energy.

The Mental Factor

Another and very subtle factor markedly affects our working capacity. I refer to our mental attitude toward the job. A simple laboratory experiment will make this point clear. In my laboratory I have an apparatus with which I can measure the

(Continued on page 155)

You Can't Cheat Fatigue

YOU can't borrow from yourself without paying back if you would maintain your solvency. This is true of your physical capital as well as of your financial reserve, as any physiological credit man would tell you.

In this article Doctor Spaeth tells how the physiological spendthrift brings himself to bodily bankruptcy by borrowing on his reserve without making replacements, and how fatigue finally collects its debt.

Doctor Spaeth is dealing with facts, not theories. The facts were determined by careful experiment and they have a vital bearing on your every-day life. Read what he has to say and then check up your own bodily capital. It may save you from physical bankruptcy.

Maude Adams as an Inventor

Beloved "Chanticler" of the Stage Perfects Radical New Process of Daylight Movies

By Truman Stevens

WHILE sweeping improvements have been made in motion pictures since the days when they were merely a scientific curiosity, in one or two vital particulars the movies until now have remained unchanged. One of these has been the necessity of exhibiting them in a darkened theater. Another has been the failure of the usual black and white tones of the images projected on the screen to create more than an imperfect illusion of the living quality in the scenes depicted.

Recently, though, came an announcement of tremendous interest to all motion-picture patrons. A process, it was said, had been perfected to show moving pictures not only in broad daylight, but in full natural color. The color effects were to be produced not through artificial tinting, staining of the film, nor by means of color filters, but by a direct method of color photography.

Actress Becomes Inventive Genius

The most amazing phase of this announcement, perhaps, is the fact that the new daylight color movie process has been developed by a person who never had been associated in the public mind with any sort of scientific or inventive work. The inventor is Maude Adams, who, when she retired from the stage five years ago, was America's best loved actress, famous for her "Peter Pan," for her "Chanticler," and for a long list of other parts that had made her the idol of theater goers.

Miss Adams conducted her researches and experiments in special laboratories

provided for her at the plants of the General Electric Company in Schenectady, N. Y., and of the Eastman Kodak Company in Rochester, N. Y. The details of the process she is said to have perfected are being kept secret.

The announcement regarding her method of projecting pictures in daylight is limited to the statement that it depends on a non-actinic light that she has developed; that is, a light lacking the chemically active properties of ordinary sunlight or ordinary artificial light. That her inventions have been brought to a practical stage of development, though, is indicated by the fact that a photo play, in which the new processes will be used already is in the making.

Colored moving pictures have been produced by various processes and with varying success since the early days of the industry. One method, dating back a score of years and still in use, consists of

applying paints or tints to the film by hand, a long and tedious process. In other processes ingenious use has been made of the principle on which color-plate printing depends—namely, that by blending two or more of the primary colors an illusion of natural color may be obtained.

One method popular several years ago depended for its success on the rapid revolution of alternate filters of red and green in front of the film in projection. The blending of these colors in the projected images created an impression of colored photography.

About a year ago Dr. Daniel Frost Comstock, of Boston, Mass., perfected another ingenious color process. In this only red-orange and blue-green rays were permitted to reach the film. The individual exposures were alternate blue-green and red-orange impressions, though the film showed only black and white. In printing, the images were superimposed. Then the film was dyed, the blue-green images taking blue-green dye and the red-orange images, red-orange dye. When the film was projected, the eye saw the pictures apparently in their natural shades.

Devotes Her Life to Science

It is said that Miss Adams' method not only is revolutionary, but is entirely original in conception. It is, in fact, the result of years of study and research.

While Miss Adams was on the stage, it is said, her chief interest, aside from her art, lay in the technical details of stage lighting. To her, the electrician of her company always was a most important member of the organization, and she spent every available moment discussing with him the various phases of theater illumination and devising new lighting effects. And during all this time she was keeping pace with the new developments in the science of lighting.

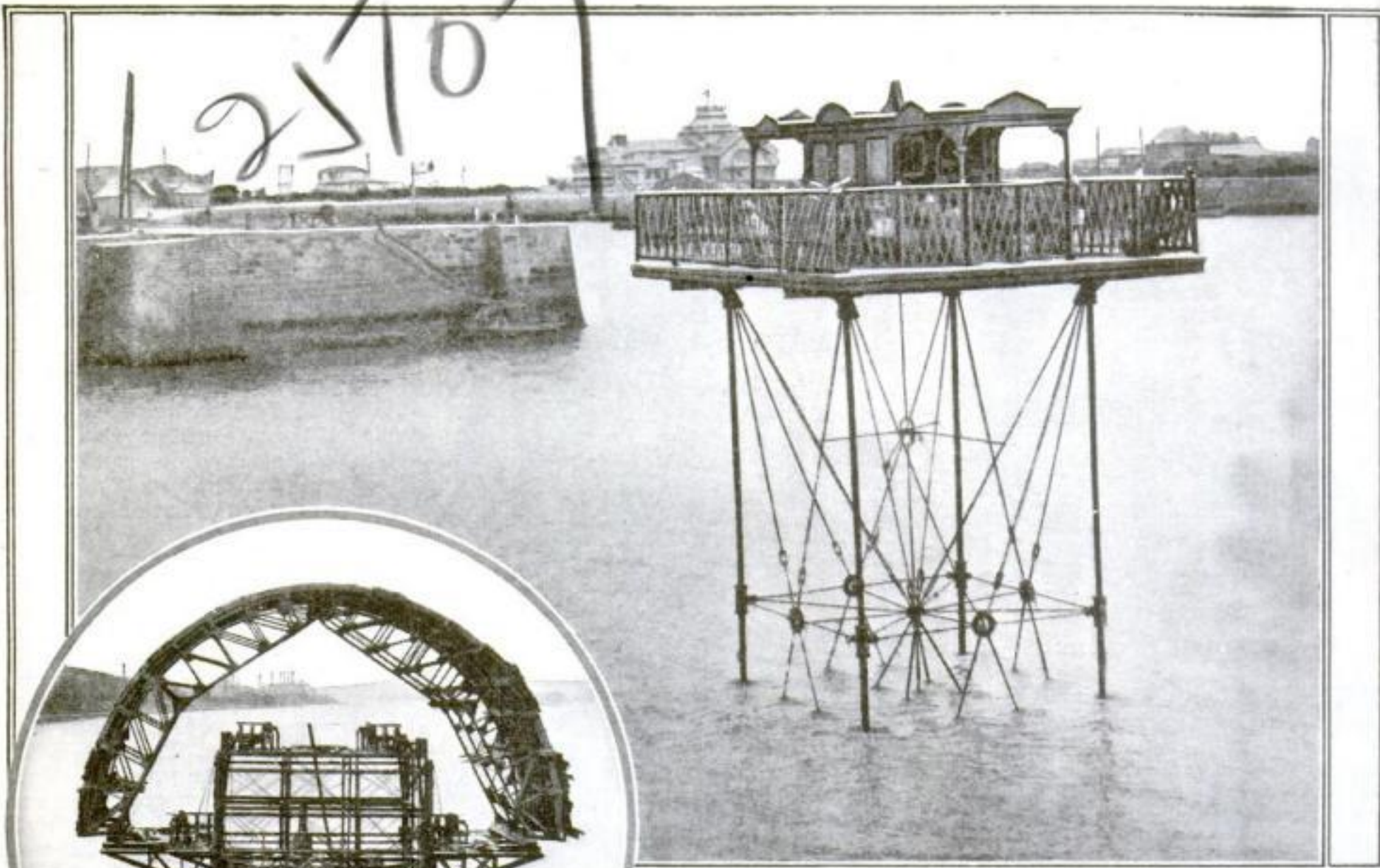
For the last five years she has literally lived in the laboratories prepared for her at Schenectady and at Rochester. Not even Edison, when he was developing the incandescent light, labored more ceaselessly than she in bringing about this new development in illumination. Her retirement was as complete as if she had entered a convent. Indeed, until the recent announcement of her work, many of her admirers assumed that it was to a convent she had gone. It was not to religion however, but to science that she had decided to devote her life.



Maude Adams as "Chanticler"

© Charles Frohman

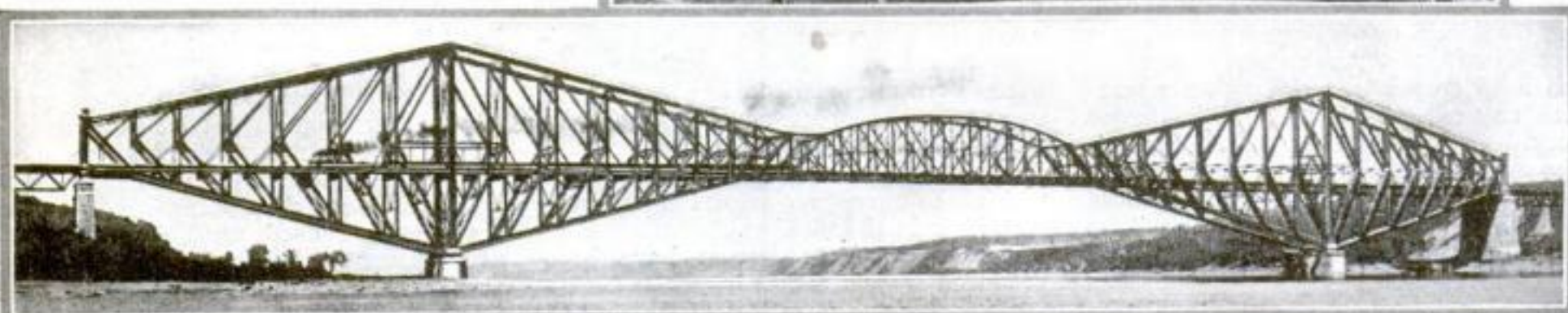
World Wonders in Bridge Building



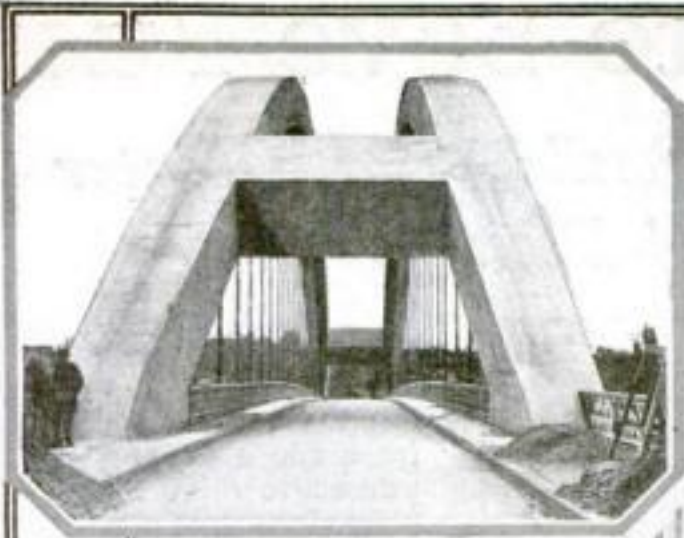
Because the distance between the ports of Saint-Malo and Saint-Servan, on the north coast of Brittany, made the building of a bridge span too expensive, the unusual moving bridge shown above was devised. It runs on rails at the bottom of the harbor, and is hauled through the water from one port to the other by a cable

Engineers who built the new Philadelphia & Reading railroad bridge across the Susquehanna River at Harrisburg, Pa., saved thousands of dollars and several weeks of labor by the ingenious expedient of floating the central arch on a barge down the river, and into its position

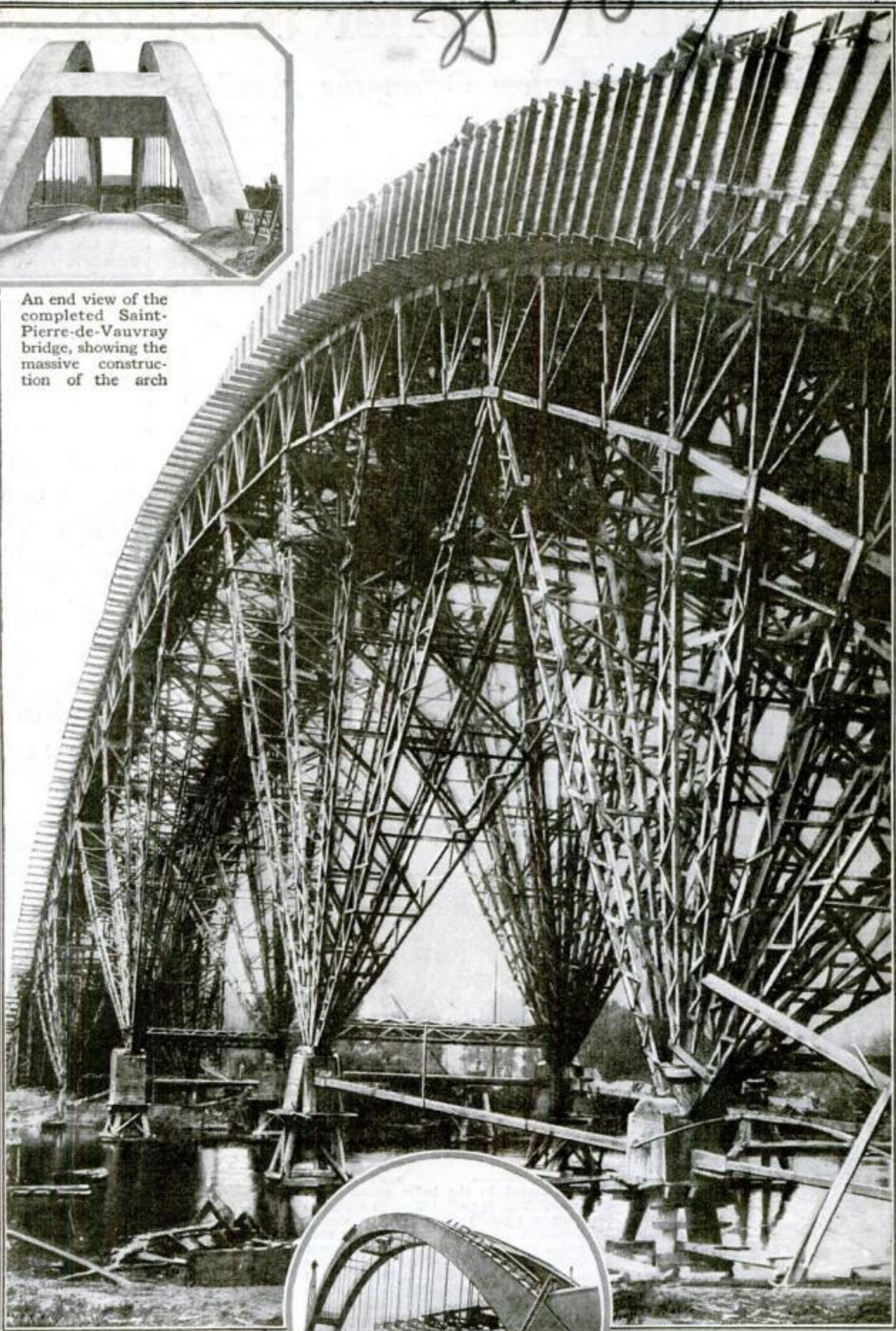
At the right is shown the odd spiral bridge spanning the Mississippi River at Hastings, Minn. Since the height of the bridge necessitated an extraordinarily long approach, this approach was built in a spiral to give access to the town's waterfront



One of the world's greatest engineering achievements is the huge cantilever bridge that spans the St. Lawrence 10 miles up the river from old Quebec. The length of the span, the longest ever built, is 1900 feet; distance between piers 1800 feet



An end view of the completed Saint-Pierre-de-Vauvray bridge, showing the massive construction of the arch



This single-arch, reinforced-concrete bridge across the Seine at Saint-Pierre-de-Vauvray, France, is said to be the greatest structure of its kind. It was officially opened a few weeks ago by President Millerand. Insets show the bridge during construction and complete

The large picture above shows the huge concrete arch during construction. It is 433 feet long and 114 feet high. Note the steel supporting structure, which later was removed by unusual engineering methods, the arch supporting its own weight as well as that of the span

New Mercury Boiler to Save Fuel

Revolutionary Power System Offers the Possibility of Cheaper Electricity for Our Homes and Factories

By Donald Harris

A NEW era of cheaper electric power and light for homes and factories is foreseen by engineers in the announcement of the successful development of a revolutionary mercury boiler which, in generating metal vapor instead of steam, promises to make one ton of coal do the work of two and to effect a tremendous saving in the world's fuel supply.

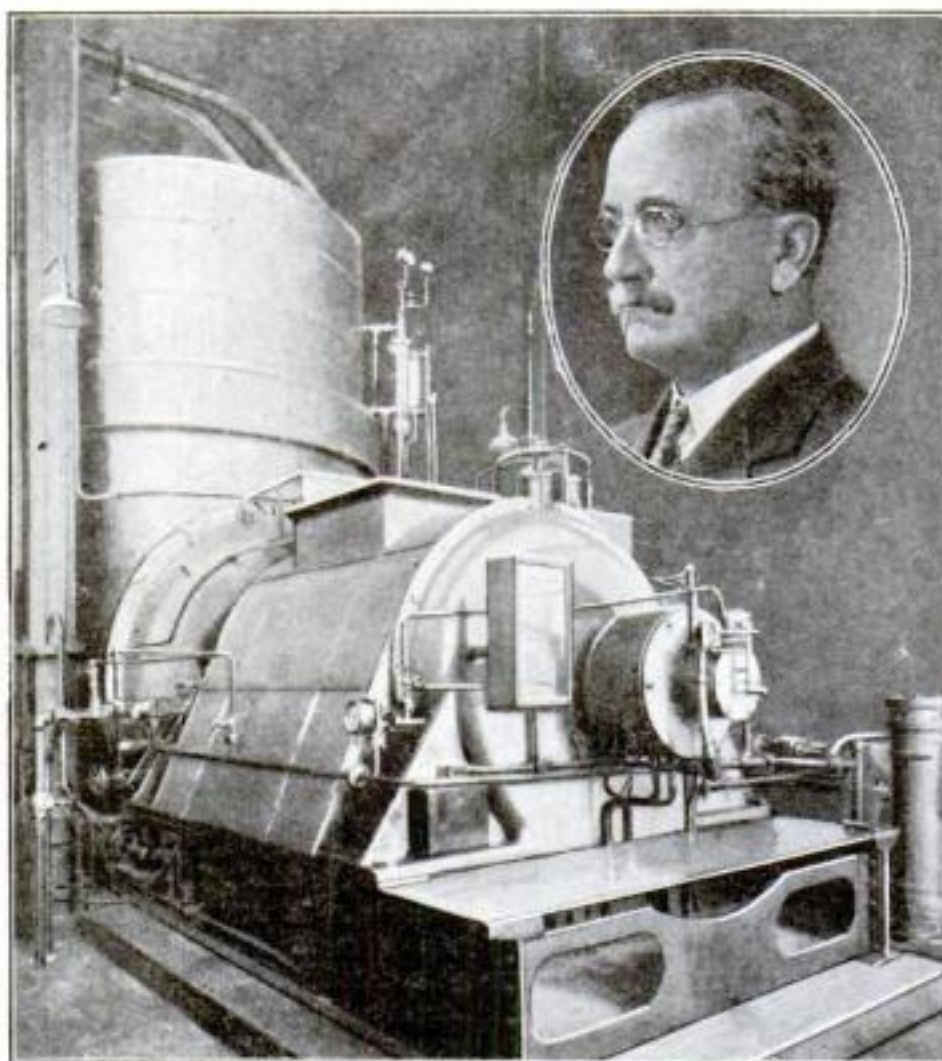
Successful Tests

The boiler is the invention of William LeRoy Emmet, consulting engineer of the General Electric Company. While it has not reached a stage of development where it can be applied generally for commercial purposes, yet in actual tests at the plant of the Hartford Electric Light Company at Hartford, Conn., it is reported to have developed 50 per cent more electric power than that produced by a steam generating plant using the same amount of fuel.

As the result of these tests, the advantages of the new power unit, in addition to the tremendous saving in fuel, are announced by the inventor as follows:

Its installation in a power house requires no radical changes in apparatus other than the substitution of a mercury boiler for the steam boiler.

The mercury is used over and over



Installation of the new mercury vapor power unit at one of the plants of the Hartford Electric Light Company, Hartford, Conn., showing the generator in the foreground and the cylindrical mercury vapor condenser at the rear. William LeRoy Emmet (inset) is the inventor of the boiler

The secret of the increased power efficiency lies in the fact that the heat generated for a single power plant is utilized to drive *two* power plants instead of one.

Reports of the remarkable performances of the invention in the Hartford plant indicate what we may expect of it eventually in the saving of fuel and consequent reduction in the cost of electric power to consumers.

Predict Huge Saving

In Hartford, with a population of 175,000, the Hartford Electric Light Company spent about \$1,500,000 in 1922 for fuel to generate electricity for homes and factories. Using the mercury power system, officials of the company announce that they expect to save \$750,000 a year on fuel with the present installation, or \$250,000 more than the cost of installing the system.

Officials of both the General Electric and the Hartford companies say that the chief saving to the public will come indirectly through the lessening of demand for fuel

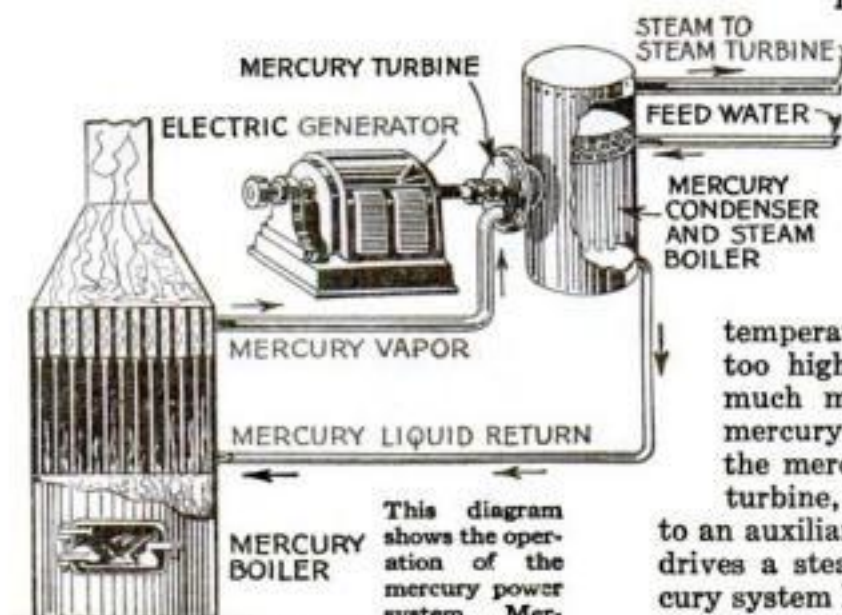
and the extension of uses for electricity, rather than through any immediate reduction of electric rates.

The idea of the mercury boiler is based on the fact that mercury boils at a much higher

temperature than water, though not too high for ordinary fuels. Thus, much more heat can be stored in mercury vapor than in steam. As the mercury is vaporized to drive a turbine, this excess heat is passed on to an auxiliary steam plant which in turn drives a steam turbine. Thus the mercury system literally "kills two birds with one" stone. It runs two power plants instead of one.

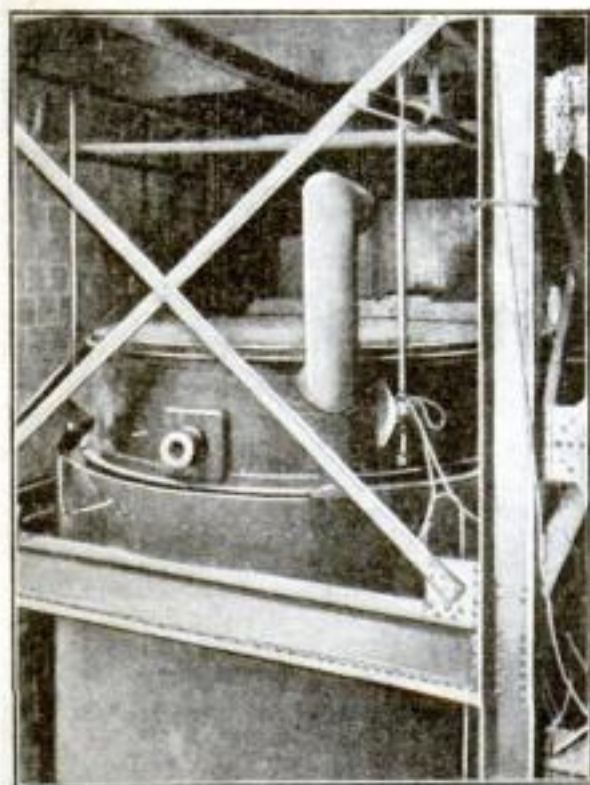
In the Hartford plant the mercury boiler occupies the space required for a 600-horsepower water boiler, yet it develops 5300 horsepower. It uses 30,000 pounds of mercury; yet experiments since its installation promise that slight changes in design will cut this quantity in half.

Mr. Emmet's apparent success in producing a revolutionary power-producing apparatus crowns a career rich in scientific achievement. The inventor is an Edison medal winner, conductor of notable research in the uses of alternating current, the developer of the Curtis turbine, and the father of electrical marine propulsion.



This diagram shows the operation of the mercury power system. Mercury heated in the boiler passes off as vapor. This is carried through a pipe to drive a turbine, which runs an electric generator. Exhaust mercury vapor then passes from the turbine to the condenser, into which water is fed. Heat of the mercury vapor exhaust is sufficient to boil this water, and the resulting steam passes through a pipe to drive a steam turbine. The mercury, now condensed to a liquid, returns by gravity through a pipe to the mercury boiler, completing its cycle

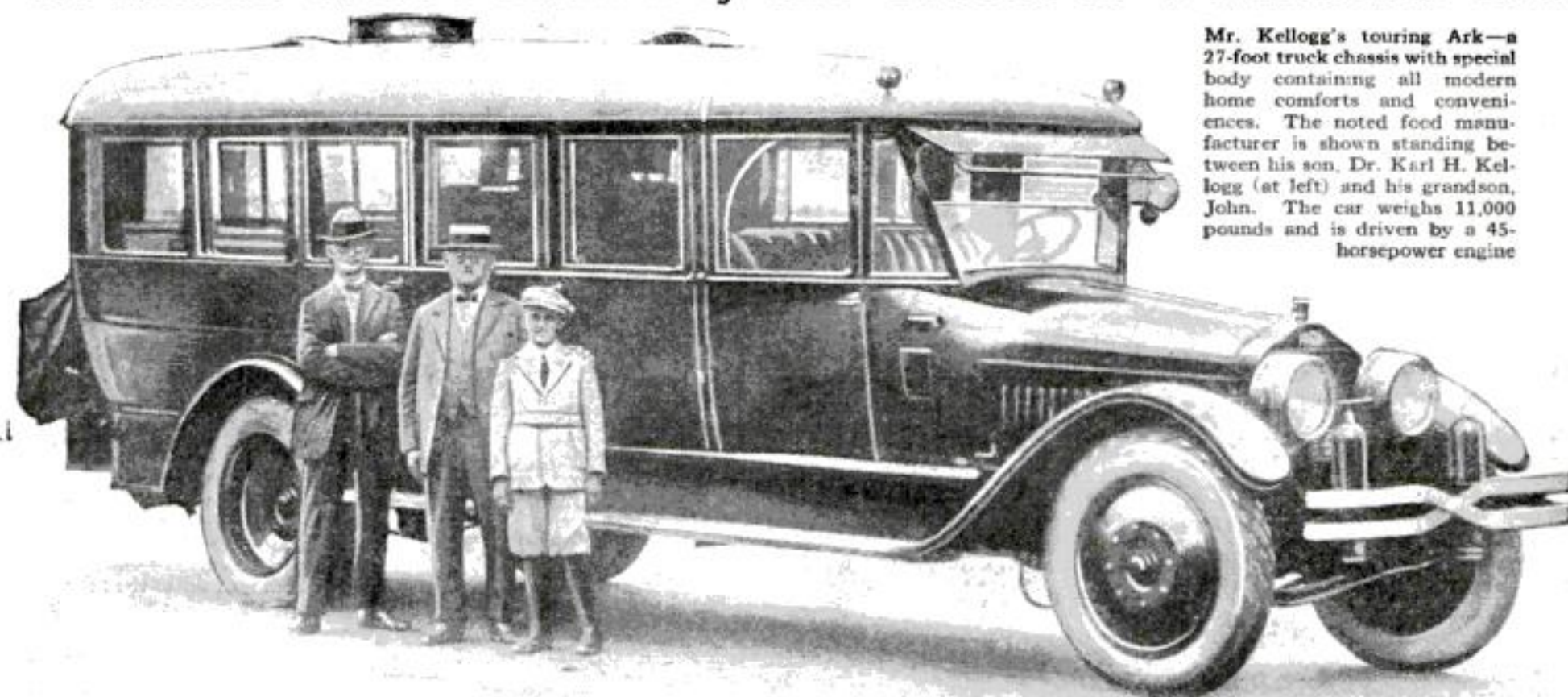
again in the vaporizing system without appreciable loss and without the necessity of replenishment. Since all joints are welded to prevent escape of mercury vapor, there is no danger to workmen from mercurial poisoning.



The mercury boiler suspended above the furnace. Vaporized mercury drives a turbine, then gives heat to generate steam

"No Place like a Home on Wheels"

A Modern Noah's Account of His Travels in a Motorized Ark



Mr. Kellogg's touring Ark—a 27-foot truck chassis with special body containing all modern home comforts and conveniences. The noted food manufacturer is shown standing between his son, Dr. Karl H. Kellogg (at left) and his grandson, John. The car weighs 11,000 pounds and is driven by a 45-horsepower engine

By W. K. Kellogg

LIKE Noah, I have built an ark.

Not that I am anticipating another deluge. On the contrary, my ark, though capable of withstanding severe storms, is strictly a land craft. Also, it was not designed to supply a necessity. It was built for amusement—so that I might give full expression to my only hobby, which is motor touring.

My Ark is a 27-foot automobile—a truck chassis on which I have mounted a special body containing all the comforts any one might desire by day or night on an extended tour.

It is equipped with beds, tables, easy chairs, a kitchen, a bathroom, a heater, a refrigerating plant, even a radio set. It carries camping equipment, including a 15-foot folding motor-boat.

It can travel at from 30 to 35 miles an hour over comparatively rough roads without discomfort to the passengers and without interrupting enjoyment of radio broadcasting programs as they are reproduced by the loud-speaker hanging over the chauffeur's seat.

The concern that built the Ark for me calls it a "special Pullman tourist coach." But it is more than that. It is a real home on wheels, permitting me to go where I please for as long a time as I please without worrying about hotel accommodations, railroad connections, or any of the other vexations of the ordinary "trip."

In the Ark is incor-

EVERY motorist or prospective automobile owner who has felt the lure of the open road will find enjoyment and profit in this unusual article by W. K. Kellogg, noted food manufacturer of Battle Creek, Mich.

Here he tells how he found the secrets of health and happiness in the untraveled places—how he conceived and built his motorized ark, a cozy traveling dwelling on wheels equipped with every appointment of the modern home, even a radio set.

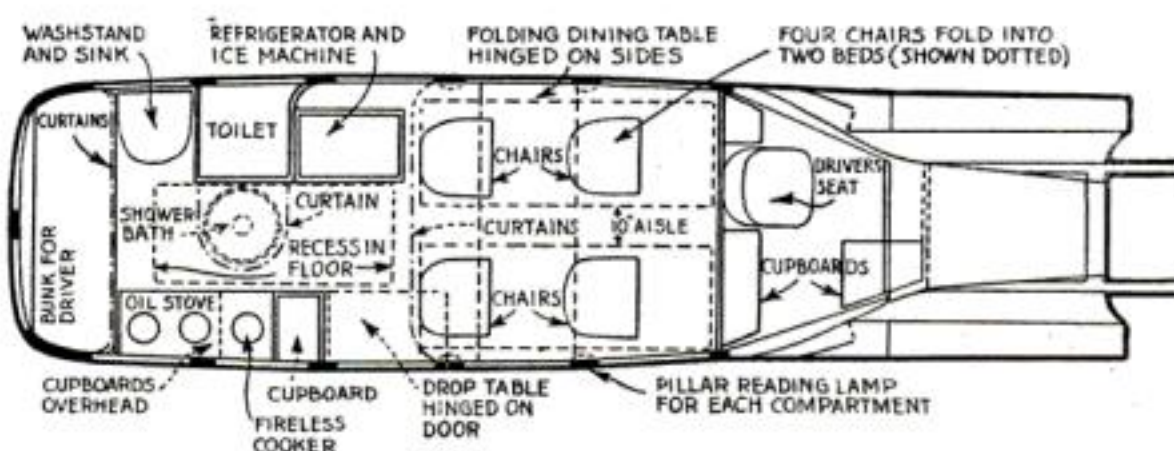
Of course, not every man can own such an ark; yet who is there who cannot find the same happiness as Mr. Kellogg's in the pursuit of a congenial hobby, or reap the same benefits in health by meeting Nature on intimate terms in out-of-the-way places?

porated the results of what I have learned in 15 years of motor touring, as well as suggestions I obtained by collecting all available data regarding the experiences of other tourists and automobile campers. It is unique, but it is in no sense a freakish

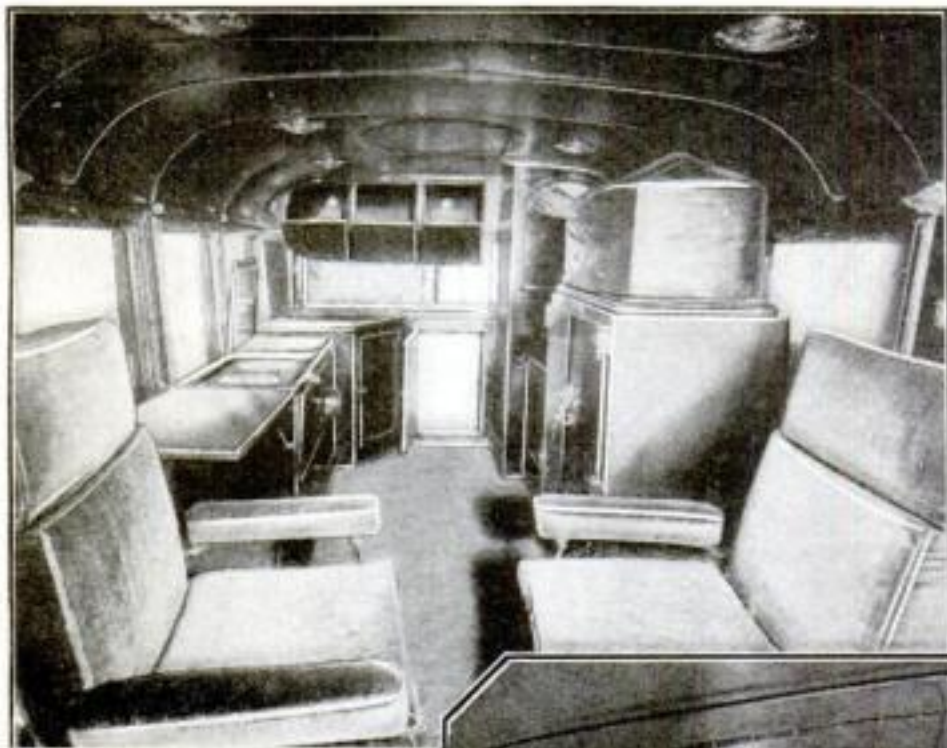
vehicle. It is entirely practical and useful. In building it I made no attempt to attain luxury or unnecessary elaboration. What I wanted was the essentials of a well-ordered home in order that in touring I might become independent of the territory through which I might travel. Thus far it has performed wholly up to expectations. Mrs. Kellogg and I now are well along on the first lap of a tour which, within the next year or 18 months, will take us to the capital of every state in the Union. This winter we are touring the South. In the spring we shall go north, then cross the continent up and down until we have completed our itinerary. Practically our entire time will be spent in the Ark. We shall travel in it, eat our meals in it, sleep in it, except for such times as we may find ourselves near good camping and fishing grounds, when we shall get out our camping gear and approach closer to Nature than even the Ark permits us to do.

This is my idea of real motoring, of getting full use out of a car. People who motor on the beaten tracks—through city parks, over well-paved roads that skirt inhabited places—miss many of the thrills that come from pursuing this healthful, invigorating sport through the open country. Playing the vagabond in a motor car is the most fascinating pastime I know of; and, in my opinion, it is the most satisfying, helpful hobby a man could have.

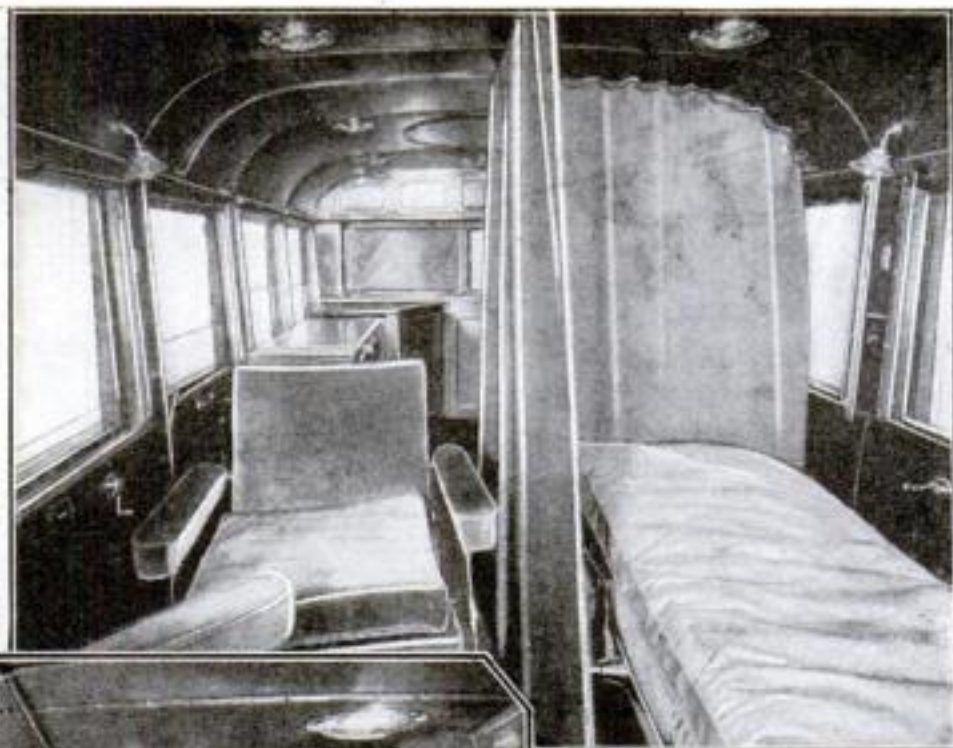
I am prejudiced, of course, but with good



Diagrammatic view of the interior of the Ark, showing the ingenious arrangement of living and sleeping quarters, and equipment of home comforts, with no waste space



Interior view of the Ark, looking toward the rear, showing refrigerating machine, electric stove, utensil cabinet, and other modern household appointments



How the luxurious sitting room is transformed into berths. The seats, at left, are converted into a bed, as at the right, with curtains extending from the roof to the floor



A light lunch on the road. This view, looking forward in the Ark, shows convenient drop tables, electric lights in the ceiling, and the radio loudspeaker at the far end. For each pair of chairs there is a table

reason; for motoring restored my health to me many years ago and has kept me in good health ever since. I had been troubled with insomnia. Nothing that I did seemed to afford me any relief. Then, almost providentially, the motor car came along. In the early days of motoring I bought a small car, from which my Ark is a logical development. In the succession of cars that followed that first one I have toured many parts of the country, mostly over highways that were little traveled.

Driving through the open spaces, drinking in fresh air, feasting my eyes on the marvelous scenery, triumphing over small difficulties and adventures and performing the work necessary to keeping a car running under rough usage—these things banished my insomnia and made me an incurable devotee of motor touring.

I found out, too, what real delight there is in pitching a tent on the bank of a stream and camping there to fish and rough it. When a man learns to do his own crude camp cooking, he gets a keen relish out of his food, a relish that is absent from the most tastefully served meal he can order at a hotel. Those who have eaten fish whipped out of a brook, cooked above a hastily built fire and served up in regular camper's style, know what I mean.

Camping Trailer Led to the Ark

I became so fond of camping that a camp outfit became a most essential part of my touring equipment. To carry it better, I hitched a trailer on my car about five years ago. That worked satisfactorily for a time, but after the novelty had worn off, the trailer became a white elephant rather than a convenience. Looking around for something to substitute for it, I hit on my Ark idea.

The Ark has a wheel base of 198 inches,

and carries a 45-horsepower motor. Its tires are 36 by six, each of the rear wheels being equipped with two. Complete, the car weighs 11,000 pounds.

How to Buy a Home

FOUR fascinating adventures in home ownership, answering in understandable language the thousand and one problems that usually confront the prospective purchaser, will appear in *POPULAR SCIENCE MONTHLY*, beginning next month.

In four articles of a series, to be published in consecutive issues, the science of home buying and home building will be explained in a comprehensive and entertaining way by one of America's foremost writers on popular architecture—Phil Madison Riley. Here they are:

1. How to Buy a Ready-Built Home
2. How to Finance the Purchase of a Home
3. How to Build a New Home
4. How to Equip the Home for Comfort

Whether or not you are planning your own home this year, you won't want to miss any of this extremely useful and interesting series.

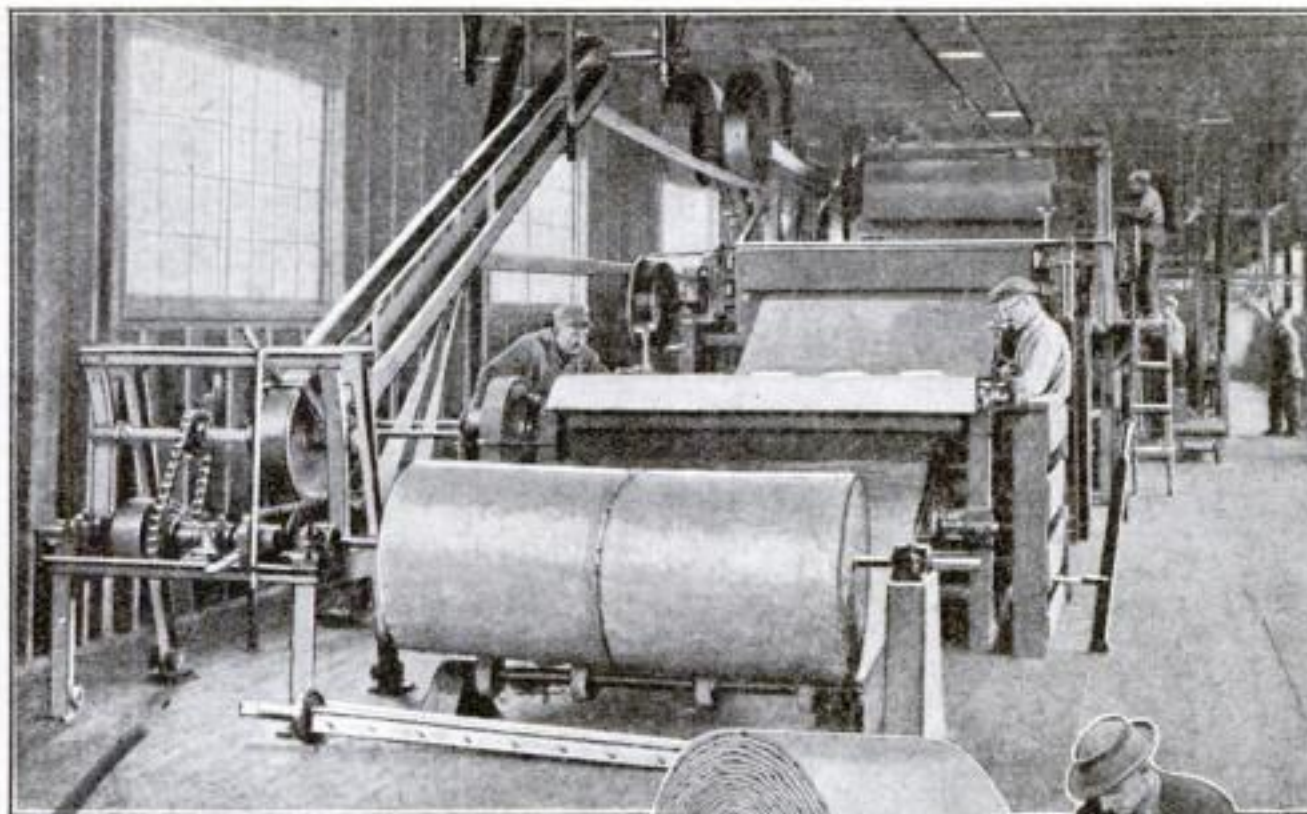
ning water from a pressure tank, an electric fireless cooker stove, a two-burner oilstove for emergencies, a heater for cold weather, and a shower bath. Minor equipment includes a telephone to the chauffeur's seat, window screens, a combination electric toaster, boiler and egg poacher in the kitchenette, and a radio set, the aerial of which is concealed in the roof.

One piece of personal equipment that I carry in the Ark, as I have carried it on all my motor tours, is a camera. A photographic diary of an extended motor trip permits you to live through your trip and enjoy it again, whenever you wish.

Plan that Summer Tour Now

Spring and summer, ideal times for motor touring, will be with us soon. If you have a car, or if you are contemplating buying a car, start making plans right now for a real tour in it before this coming summer ends. Pick out a route that will take you away from the inhabited places. Get a camping outfit and sleep in the open. Take a camera along and let it keep a diary for you. Thousands of people in the United States are doing that every year. They are getting real value out of their cars, even receiving dividends in the form of health and happiness on what their cars cost them.

Fireproof Wall Lining Made from Waste Lumber



Part of the factory at Cloquet, Minn., where fireproof "wool" is manufactured from waste

HOUSEHOLD fuel bills can be cut from a quarter to a third, it is claimed, by insulating the walls of the home with a fireproof "wool" now being made from waste lumber at Cloquet, Minn. This material is said to be nearly as effective an insulator as pure wool, which, of course, is too costly for building purposes.

The insulator is a flexible blanket made of spruce lumber waste cemented together and packed between two sheets of asphalt-lined, tough, waterproof paper. The waste is chemically fireproofed first, and then thoroughly dried by fans and several miles of steam pipes. Shredding machines macerate it thoroughly, this



Testing the fireproofing of the new material with a blowtorch. It is said to take 4 1/2 minutes for the flames to penetrate the half-inch thickness of the material

process creating more dead air spaces. Finally, it is cemented with a special adhesive, dried and packed between the sturdy covering sheets. These previously have been coated on one side with a film of hot asphalt that cements them to the



Applying the insulator to a wall. The strips, 16 1/2 inches wide, are said to fit snugly between the studs, automatically forming flanges along the sides and ends. These flanges are held tightly against the studs and plates by lathe or nailing strips. Thus every crevice is sealed tightly

wool mat and makes them moisture-proof. The finished product is said to be light, flexible, and easy to apply. Because of its flexibility it accommodates itself to shrinkage or vibration of the building framework.

The effectiveness of the fireproofing was demonstrated strikingly when, in a recent test, a blowtorch required four minutes to penetrate the material. The chemicals in the fireproofing are said to have extinguished the fire soon after the torch was withdrawn.



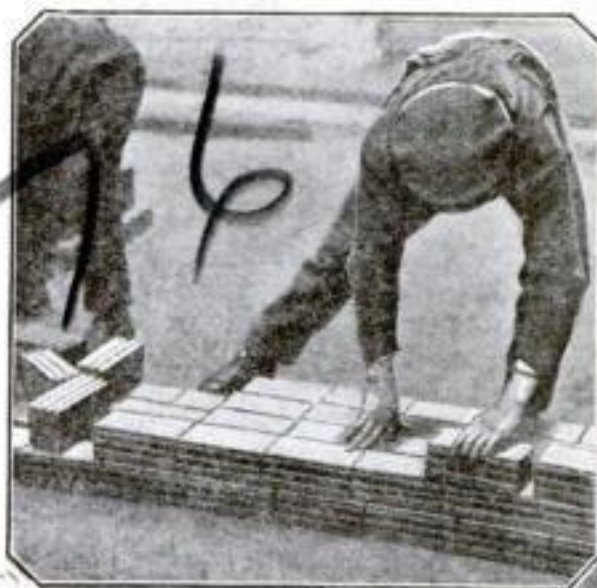
An Ice-Cream-Can Opener

THE difficulty encountered in removing ice-cream-can covers that have been frozen fast has led to the invention of this cover lifter—a bottle opener on a large scale, with a long upper jaw and a short lower one that hooks under the rim. The lid is raised with little effort.

Noiseless Street Paved with Rubber Bricks

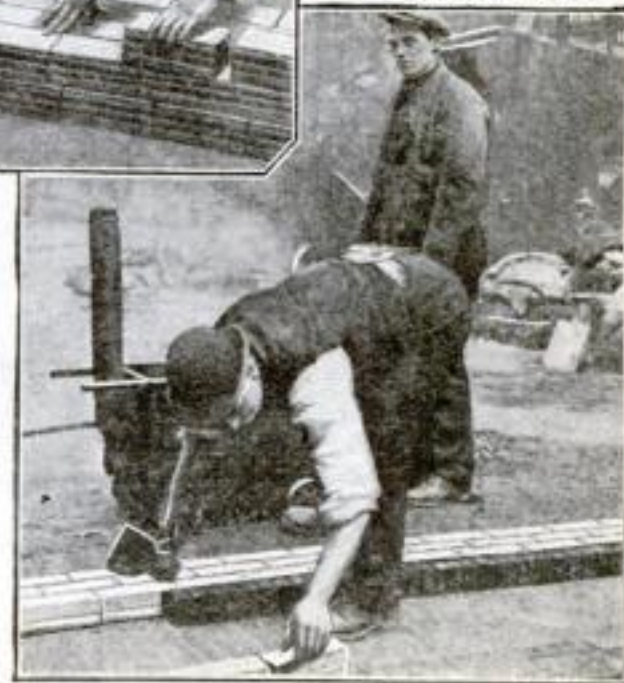
THERE is one street in the world through which the heaviest traffic may pass without noise. It is a street called "Holborn" in London, England, which has just been paved with rubber bricks. M. E. P. Spurrell, borough surveyor, supervised the installation of this novel pavement, of which he is the inventor.

The rubber bricks are similar to the wood blocks extensively used in street paving and measure 9 by 4 1/4 by 3 inches. It is expected that they will last for at least 15 years and they can be manufactured for the same price as ordinary creosoted wood blocks.

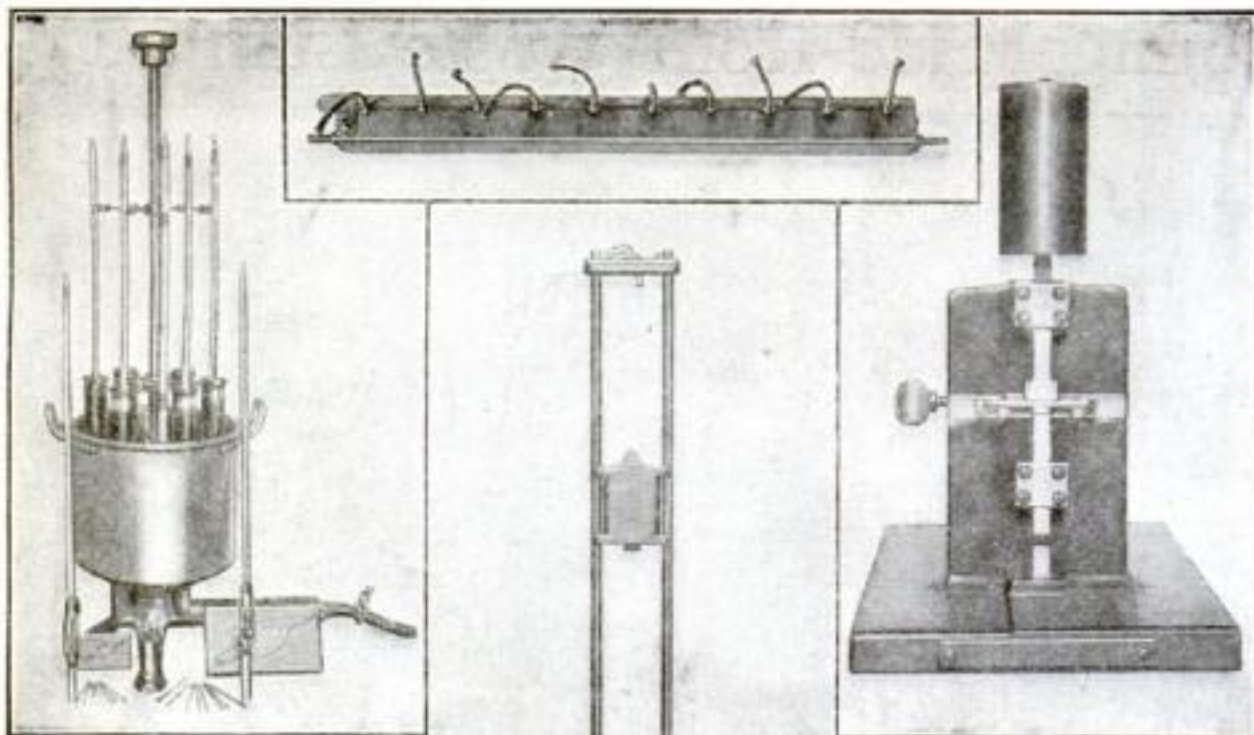


Workmen paving a street in London, England, with rubber bricks. These blocks are shown piled at the left. They are grooved at the sides and are laid so that they fit into each other on a solid concrete base

Photos courtesy Highway Magazine



THE Editor will be glad, wherever possible, to supply the names and addresses of manufacturers of devices mentioned in Popular Science Monthly. Letters of inquiry should include the month of issue and number of the page on which the device is mentioned.



Above: Matches subjected to temperature test in hot oil. Top: The wooden sticks must burn to the bottom without breaking or dropping

Above: The match stick subjected to strain at the center. At left: Dropping a miniature pile-driver weight on the match head

How Science Tests Matches for Your Safety

THE plebeian match, common, cheap, yet sometimes capricious, receives respectful treatment from the Underwriters' Laboratories. Above are pictured scientific tests by which the laboratory investigators keep your matches safe for you.

First, several of the matches on trial are placed in tubes equipped with thermometers and resting in oil. The oil then is heated until the matches ignite. If ignition occurs below a temperature considered safe, the matches stand condemned. They could not, for example, be kept near stoves.

Next, 10 matches are inserted shallowly in sockets along a metal testing bar, and lighted. They must burn to the bar without dropping burned heads or bits of

charcoal. Unless they pass this test, one of their brothers some day might cause a disastrous blaze by dropping unobserved a lighted or glowing head.

A match now is laid with its head on a tiny metal pedestal, its wooden body resting in a groove of an adjacent pedestal. The match head is directly beneath a sliding weight that resembles a pile driver. This weight is such that a safe match will not ignite when struck at the end of its fall.

Finally, a match, supported at each end, is strained by a gradually applied weight. If the wood remains uncracked, the matches are not likely to break in two when struck, so that the blazing end might endanger curtains, paper, or hair.

New Weight Machine Measures Pull of Horses

BY MEANS of a weight-lifting machine, the pulling power of horses, as well as the effect of various road surfaces on it, has been determined with great accuracy by the Horse Association of America. The machine, called the "dynamometer," is the invention of Prof. E. V. Collins of Iowa State College.

At the recent National Horse Show in New York City, Bob and Pete, a team of 10-year-old truck horses, weighing together 3500 pounds, accomplished a pull equal to lifting 2450 pounds from a well, a feat said to have astonished veteran horsemen.

In other tests a team of mules, weighing 2600 pounds, failed to raise a 2000-pound weight, this being attributed to their lesser weight.

The tests are said to have demonstrated that horses can pull from six to eight times as much as usually is required of them, particularly on city pavements.

Old and worn brick paving was found to require a tractive pull of 290 pounds—almost two horsepower—for a wagon and contents weighing six tons, while new and smooth brick paving required only 200 pounds, about 1 1/3 horsepower.

On asphalt paving the required pull increased to 560 pounds, or 4 2/3 horsepower. Concrete paving was found the least exacting.

Dirt roads, apart from their greater ease to the horses' feet, demanded greater pulling power than did roads that were paved. The same was true of gravel and cinder roads.

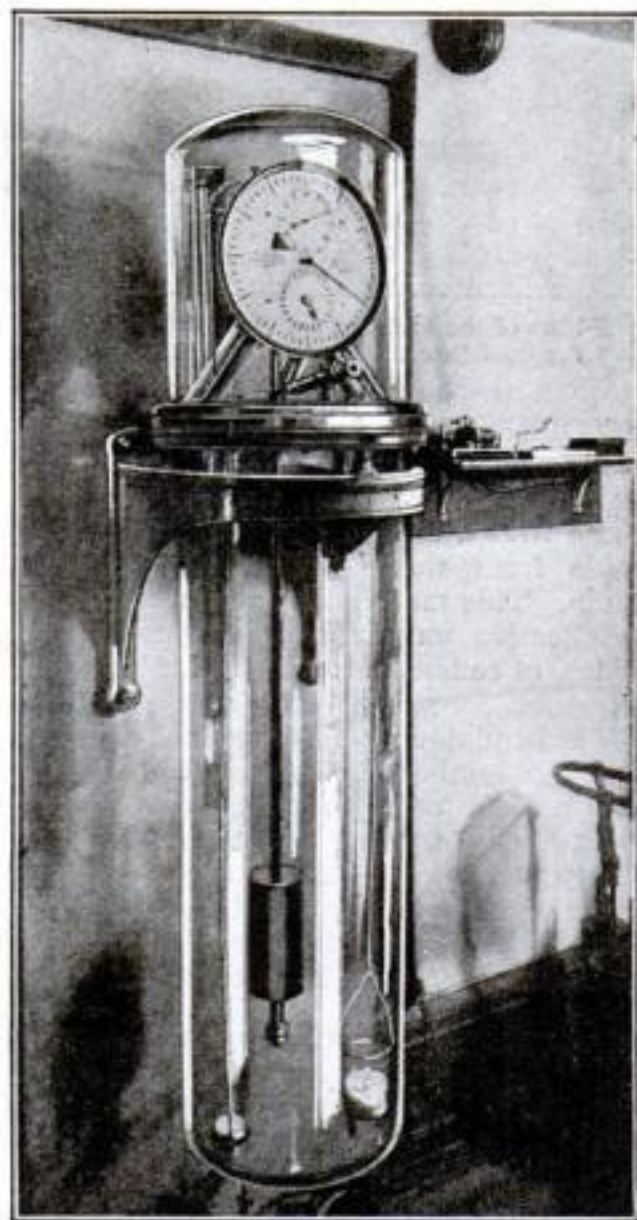


Measuring the pull of a team of truck horses hitched to the weight-lifting machine

Most Accurate Clock Ticks in Airtight Room

A CLOCK that has varied less than one second in 2 1/2 years ticks off the hours in the Case School of Applied Science, Cleveland, Ohio. It is said to be the world's most accurate timepiece.

It is mounted in a special airtight room, surrounded on all four sides, ceiling, and floor by four-wall partitions, which provide three separate air spaces. Its foundation is a stone pyramid, which in turn rests on a concrete base 16 feet square. Beneath this concrete is the natural shale upon which the building rests. Thus approximate freedom from



This clock at the Case School has varied only a fraction of a second in 2 1/2 years

vibration is achieved. This room is entered through a temperature trap with four doors.

Accuracy is enhanced by the fact that only a suspended ribbon of spring steel gives contact between the counting mechanism and the pendulum. The latter is an alloy of nickel and steel, which is declared to be almost undetectably affected by temperature changes. Automatic winding is accomplished electrically every 32 seconds.

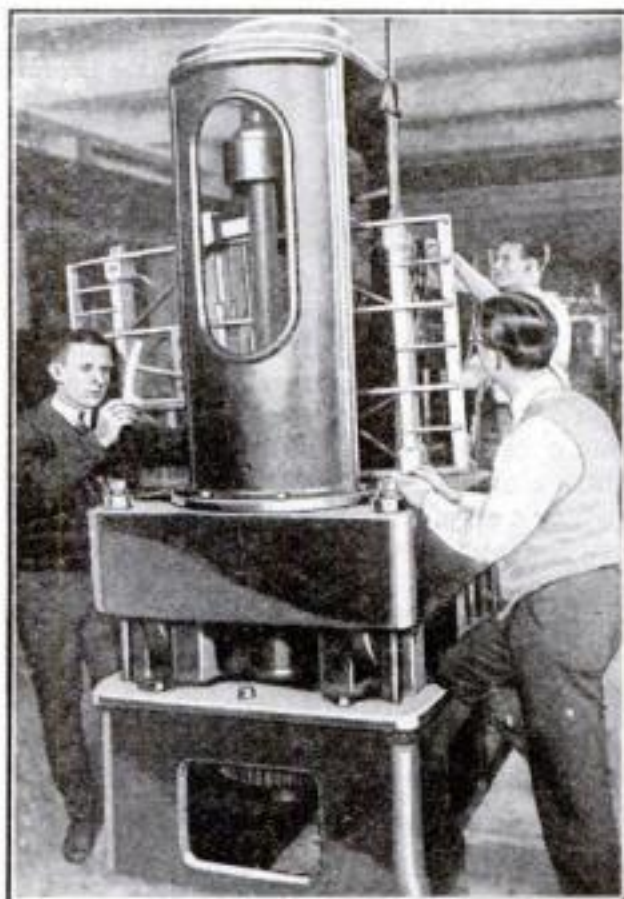
The air through which the pendulum swings is rarefied by a pump that automatically compensates for temperature changes. A change of one millimeter in air pressure, it is said, would vary the clock's rate more than one hundredth of a second a day.

OWING to the large number of contributions in the contest, "Why I Value My Hobby," it is impossible to announce the prize-winners this month. The announcement will appear in the April issue.

University Offers Course in Airplane Design

THE first college course in airplane design and construction to be offered in the United States has been launched at New York University, New York City. A surprisingly large enrolment attested the demand for such instruction.

The innovation has been indorsed by President Coolidge and high army and



Testing lifting power of airplane wings

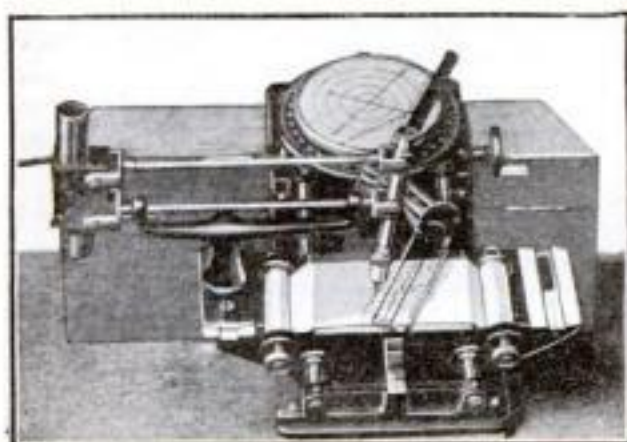
navy officials, who have expressed the deep hope that it may result in American leadership in aeronautical construction and performance.

The photograph shows students in the laboratory of the university testing the lifting power of an airplane wing by subjecting it to high pressure. The course is under the direction of Prof. Alexander Klemin and a corps of technical experts.

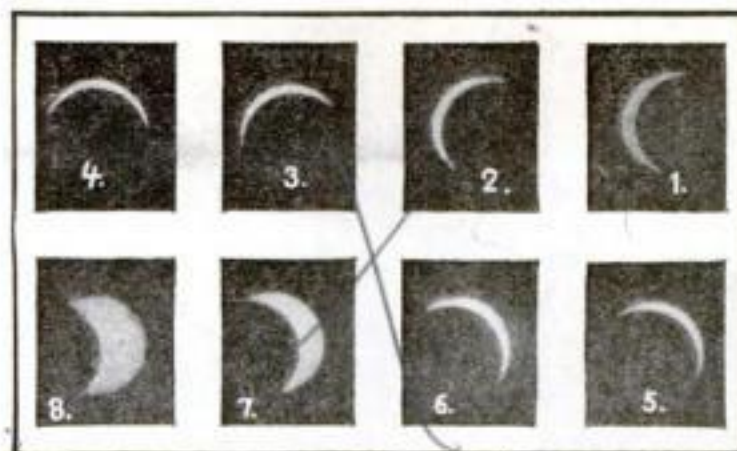
Mechanical Aerial Pilot Measures the Wind

PRECISE measurement of the drift of an airplane off its course, due to a side wind, is said to be possible with a new instrument, designed to calculate wind velocity and to indicate the true course of an aircraft.

It determines instantaneously the angle at which the aviator must fly to windward of a straight course in order to reach his destination without having to turn back from leeward. This measurement is automatic.



Wind-measuring machine guides air pilots

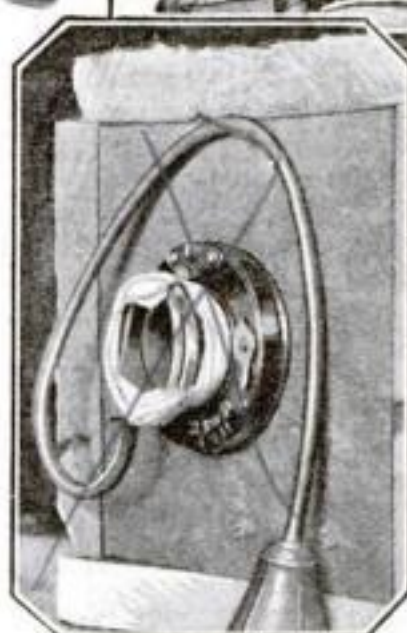


Eight stages of solar eclipse, showing passage of the moon's shadow across the sun from right to left

Eclipse Photographed by Homemade Camera

FOUR seven-foot boards, three lenses from old spectacles, some black building paper, a camera shutter from which the lens had been removed were combined by George Tauchmann, of Berkeley, Calif., into a homemade astronomical camera with which he took excellent photographs of the recent solar eclipse. These photographs are reproduced above.

The boards formed a six by six inch box, which the black paper lined to keep the light off the inside walls. The three spectacle lenses then were laid on each other cross-wise and were bound with white friction tape to keep them together. This tape also was used in fastening the improvised lens to the front opening of the



George Tauchmann, of Berkeley, Calif., standing beside his homemade astronomical camera. At the left: How three spectacle lenses were fastened over the camera shutter

shutter. Part of this tape is cut away in the accompanying illustration to show the glasses more clearly.

A half-inch opening, about 1/170 the length of the focus, was used and an exposure of 1/25 of a second given each picture.

Invisible Writing Made Visible by Detector



The inventor with his writing detector

MANY a precious literary relic may be recovered, after centuries of oblivion, by a new German method designed to make visible papyrus and parchment writings that apparently have been obliterated. This method also may be applied to military intelligence and scientific crime detection by revealing invisible writing.

Thousands of ancient manuscripts were erased during succeeding centuries so that the papyrus or parchment might be used again. Papyrus writing was erased by passing a wet sponge over it, and parch-

ment writing by rubbing it with pumice-stone.

It was to recover this lost literature that Prof. H. Kögel, of Karlsruhe, Germany, invented the new detector.

Parchment and papyrus belong to a class of substances that give off a faint yellow light when exposed to ultra-violet rays. When such rays are directed at one of the ancient manuscripts, all but the parts once wetted with writing fluid are said to give off this yellow light, making the invisible writing visible.

Quartz instead of glass is used in the detector because glass absorbs ultra-violet rays. A quartz lamp produces the rays, while two quartz prisms spread them in a long spectrum on a screen about 10 feet away, after sending them through a narrow slit.

*Uti a uris papyrus uerbarum ee quo
umple. Aud a salomone edificatum
esuer ing regu filit uirgines a
ppheraru a summa sacerdotu a ponti
fici a magne ac mirapiles a mercuru
tam uenem et adlegni ferarem*

Papyrus writing revealed by the detector



This Indoor Football Game Requires Kicking Skill

A NEW game of indoor "soccer" football has recently been invented by Percy Mason, of Hendon, near London, England, to give devotees of the kicking game a popular household version of the sport. It is said to afford much of the excitement of offensive play and skilful passing across the field that is found in the outdoor game.

The game is played under a net, which is mounted upon a rigid support in such a way as to allow each player sufficient

room between the net and the floor for him to insert his foot. Each player therefore has a limited field of action, and a considerable amount of skill and practice is required before he can learn to use this small space to best advantage.

World's Smallest Fishes

PROBABLY the smallest species of fish in the world—the smarapan—is found near Luzon, Philippine Islands. It weighs half a grain, and is half an inch long.

World's Greatest Aquarium Has 57 Tanks

WHAT is said to be the world's most perfectly equipped aquarium was completed recently in Golden Gate Park, San Francisco, at a cost of \$300,000.

Fifty-seven ponds and tanks are pro-

vided for an unusual variety and number of fishes. Thirty pools and aquaria will shelter other marine creatures. There are three outdoor pools for seals and a special pond for alligators, snakes, and turtles.

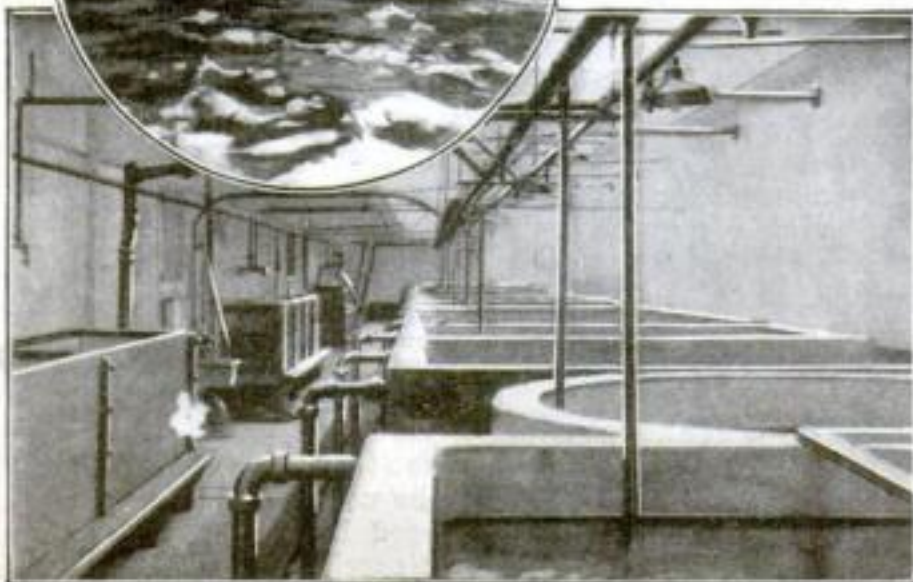
A complete heating plant and a complete refrigerating plant supplies warmed and cooled water for tropical and arctic fish respectively.

An impressive biological library and a thoroughly equipped laboratory will afford students and research workers unusual opportunities. A large collection of stuffed fish and other marine animals will supplement these facilities.



One of the large tanks in the new San Francisco aquarium is shown above. The picture in the circle shows one of three outdoor pools for the use of the seals

At the right: A view of some of the 57 tanks for fishes, showing the pipes that convey water from heating and refrigerating plants that keep it at correct temperature



Convenient Notary Seal Resembles a Watch

A NOTARY'S seal that resembles a watch now is available for notaries who travel or who for other reasons often are called upon to seal documents away from their offices. It can be carried either



Pressure or a slight blow on the case makes the impression

in the vest pocket, as a watch is carried, or in a lady's purse or handbag.

To seal a document with the device, one opens the case, inserts the paper and then closes the seal. Pressure with the fist, or a slight blow, will effect the desired impression.

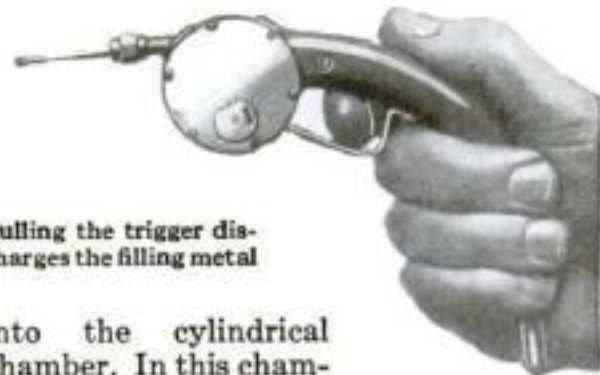


The notary's watch seal, with case open (above), showing the embossing punch and die, and with case closed (at the right)

Dentist's Pistol Designed for Filling Teeth

YOUR dentist soon may be filling your teeth with this compressed-air pistol, a recent Australian invention that discharges gold or amalgam into the cavity.

Pulling a trigger opens and closes a spring-controlled valve in a channel extending through the handle of the device



Pulling the trigger discharges the filling metal

into the cylindrical chamber. In this chamber a wind wheel, or rotary fan, is whirled by the force of the air pressure conveyed in the tube to which the pistol is attached. When the trigger is pressed, the rotating fan discharges the gold through the small barrel.

The instrument is said to replace the slower method of picking up the filling material particle by particle.

Self-Inking Drawing Pen Makes Uniform Lines

FOR architects, artists, and others who do drawing or lettering involving uniform lines of various thicknesses, a new tubular fountain pen has been invented. Eight points of different thicknesses, each connected with a tubular ink reservoir, are used in the same penholder, fitting in the holder as do ordinary points. A plunger, the tip of which projects slightly beyond the tip of the point, runs through the pen into the ink tube. The hollow interior, which is filled with ink, is said to have greater capacity than most pens made for this purpose.

Using the pen pushes in the projecting tip of the plunger, releasing ink in a con-



Sandpaper Gives Warning of Poison in Bottle

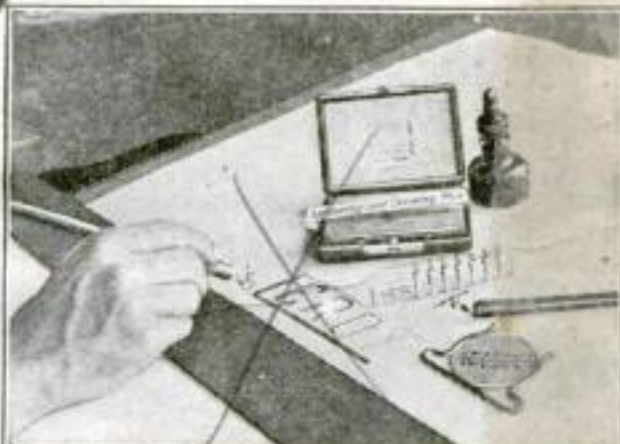
POISON bottles and bottles of harmless medicine feel the same to fingers in the dark. As a precaution against any possible mistakes, paste a strip of sandpaper on the poison bottles.

Metal Grip for the File

THIS metal grip, said to fit the handle of any file, protects the palm of the hand from irritating contact, besides providing a surer grip.



Cut-away view, showing handle attachment



Lettering outfit, showing interchangeable pens

stant flow and insuring a uniform line independently of the pressure applied.

A setscrew on the point permits adjustment of the drawing angle to individual preference. The pen also is adapted to follow the edge of a T-square and to be used as a ruling pen.

Dump Carts Supplanted by Aerial Railway

BECAUSE the disposal of valueless earth by cartage proved too expensive, an Iowa clay products company has constructed an unusual aerial railway running to the dumping space. Two

parallel cables were strung to a supporting tower. A suspended track, swung 30 inches below the cables over the first 30 feet of the aerial course, permits an earth-carrying car to travel to a point above the dumping space. There a bumper stops the car, and the operator, by means of a lever control, dumps the contents.

This method is said to have cut the cost of earth-disposal from 30 cents to about three cents a yard.



The aerial railway along from ca

the car is halted by a bumper

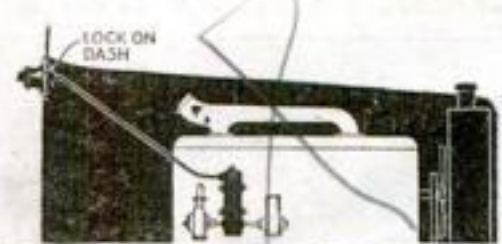


Louis Reichart at work on the auto alarm clock that he has invented

Novel Auto Lock Sounds a Warning Rattle

A STARTLINGLY unpleasant surprise awaits the thief who undertakes to steal a car equipped with a new protecting device that causes a betraying chatter, loud enough to be heard several blocks, as soon as the car is started. The device is the invention of Louis Reichart, a construction engineer of Philadelphia, Pa. It weighs but a few ounces.

Unlike other alarm devices that depend on a lock or on current from the battery,



Installation of lock and dash control

this invention can be silenced neither by a thief's key nor by disconnecting wires.

A toothed wheel is attached to any exposed shaft, upright or vertical, on the engine. A spring tongue engaging the wheel is controlled from the dash by a keyless lock capable of an infinite number of combinations. When the owner leaves the machine, he sets the lock, causing the tongue to engage the teeth of the wheel. Any attempt now to start the motor, by causing the shaft to rotate, will set up the chattering that betrays the thief.

A split aluminum housing guards the entire assembly, which, of course, is mounted on the shaft. The device is said to function on right- and left-hand motors.

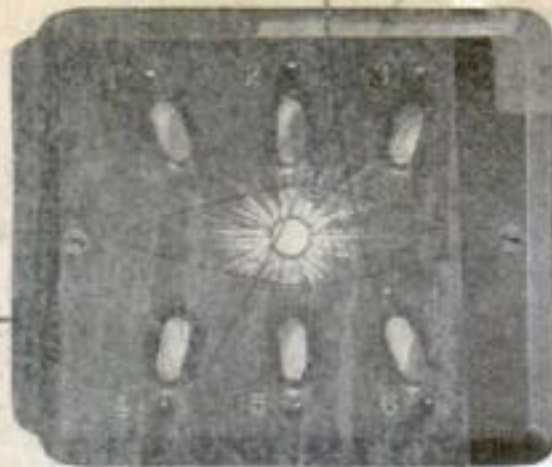
Declares Ants Are Topers

ANTS consume more alcohol in proportion to their body weight than does the most accomplished "old soak," asserts Prof. Paul Lindner, chief of the Fermenting Industry Institute in Berlin, Germany. The industrious insects manufacture their own home-brew in their digestive canal by the action of yeasts on the milky juices that they extract from aphids, or plant lice, which they keep for that purpose.

Other insects have similar homemade home-brew outfits that they use to capacity, Doctor Lindner stated. Wasps are accomplished bootleggers.

Dash Indicator Locates Faulty Spark Plugs

DIAGNOSING spark-plug trouble with six buttons and a light, this ingenious automobile dashboard convenience aid to reveal instantly which cylinder



Above: The dash indicator, showing lighting system that betrays faulty spark plugs when button is pressed. Below: The signaling apparatus

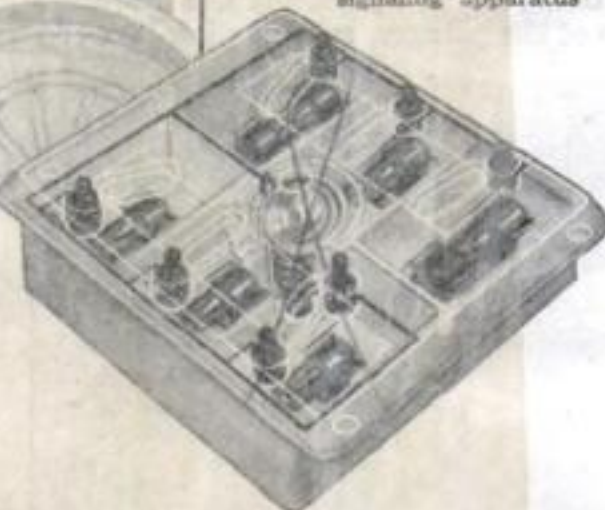


How the spark plugs are connected with indicator on the dash and with storage battery

is at fault and what is wrong. Moreover, the device has been made capable of testing itself.

The indicator is fitted with six buttons, each with a corresponding vacuum tube, and with a central light. Each button is connected with one of the spark plugs.

Should a plug be operating defectively because the points are too widely separated, or because of a carbon or oil deposit increasing the resistance, the guilty plug is identified by pressing, successively, the various indicator buttons. A light will glow in the vacuum tube corresponding to it. This is because the wiring system permits the current to pass through the vacuum tube instead of the plug if the resistance is too great.



On the other hand, should the plug points become faultily adjusted, so that the current has a lower resistance and no spark results, pressing the indicator buttons again will inform the driver. The central lamp will light when the button corresponding to the miscreant plug is pressed.

Even the device itself can be tested. A test button is provided, which, when touched, will cause the central light to glow if the instrument is functioning properly.

Gas Replaces Steam in Railroad Locomotive

ENGINEERS of the newest locomotives on the Chicago & Great Western lines no longer open the throttle. Instead, they throw her into high and step on the gas, for the new locomotives are gasoline-driven—actually big automobile engines.

Except that there is no necessity for a steering wheel, driving these engines is exactly the same as driving an automobile.

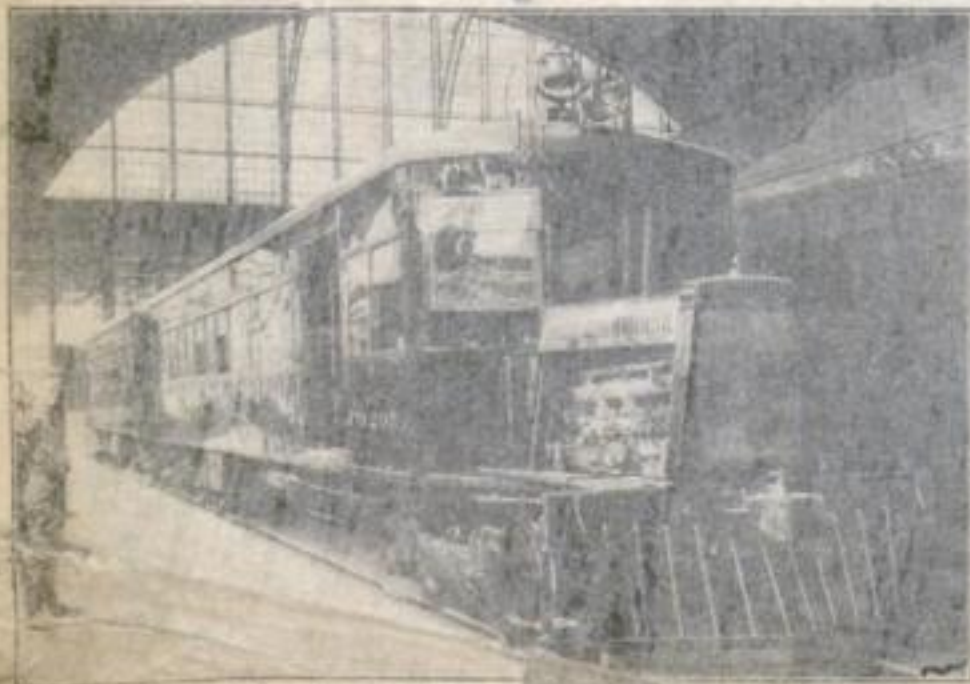
The motor-driven locomotives are said

to have proved themselves capable of remarkable performances, and the experiment of the Chicago & Great Western is being observed with interest by the executives of other railways.

The new locomotive is driven by a six-cylinder engine said to develop 245 horsepower. It is provided with five forward and two reverse speeds. Maximum speed is 60 miles an hour in forward motion, and 15 miles an hour backward. The weight of the entire car is 39,000 pounds.

Power is applied to one pair of wheels on each of the two trucks, making a four-wheel drive mechanism.

At the rear of the engine and driver's cab is a compartment for express and baggage, also a smoking compartment with capacity for seating 30 passengers. The standard railway air brake and coupling are used.



Six-cylinder gasoline locomotive engine, 245 horsepower

Tiny Electric Fan Screws into Light Socket

FOR muggy summer days, a little portable electric fan, only slightly larger than a man's hand, has been invented. It screws into any light socket and the high-pitch of its blades is said to enable the tiny high-speed motor to throw a strong current of air.

A universal joint between the fan and the motor permits the blades to be turned in any direction.

The marked pitch of the blades is said to account for the fact that a far stronger air current, in proportion to size, is possible with this midget fan than with one of the usual size. A similar pitch on an ordinary fan would tend to topple it over.



The tiny fan, showing pitch of blades

Merchant Uses "Stand-Up" Desk to Keep Well



George Lytton working at his desk

TO GEORGE LYTTON, wealthy Chicago merchant and former national amateur heavyweight boxing champion, lounging on his backbone while he worked seemed to be devitalizing, not to say dangerous. Believing that mental vitality is directly proportional to physical vitality, he devised this "stand-up" desk. Standing at the desk he does whatever office work the day requires of him.

He declares that as a result of his new system he feels more fit in every way at the end of the day's labor.

Convenient Tray Designed for Berry Picking

A NEW berry tray, designed to permit the use of both hands in picking the vines or bushes, has been invented by George H. Owen, of Addison, N. Y.



Both hands are left free for picking

The device has an arched side resting against the picker's body and an inner section, removable by a handle, into which two berry boxes fit.

The entire device is supported by a cord about the neck and shoulders of the berry-picker. The handled inner section may be lifted out when filled and

replaced with one containing two empty boxes. The invention is said to be comfortable to carry.

Two-Piece Tire Rim Said to Eliminate Bolts

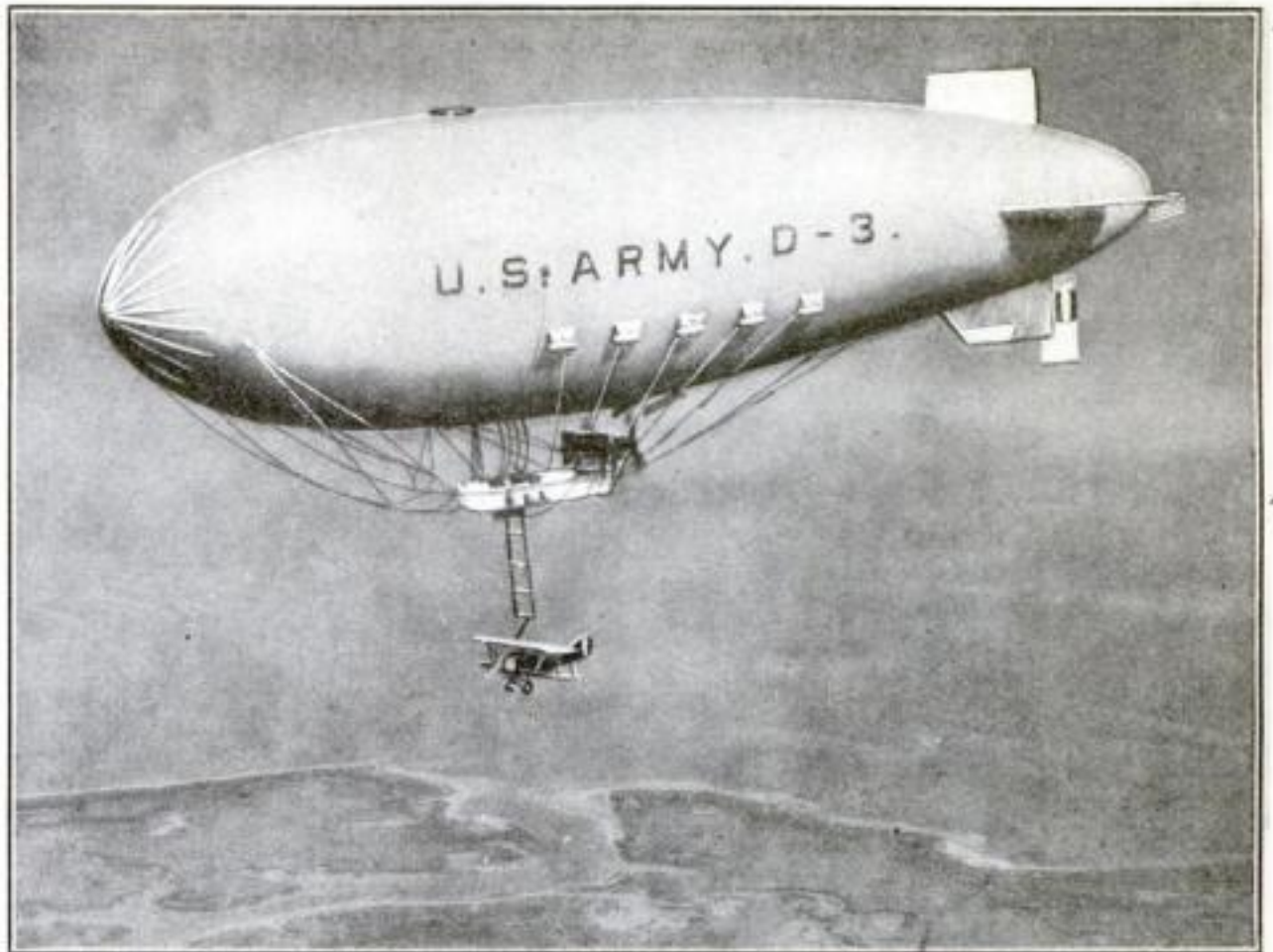
A TWO-PIECE tire rim, said to eliminate bolts, screws, lugs, and rivets, is one of the latest contributions to the convenience of motorists.

The main rim has a recess extending halfway around the circumference, into which a tire locking piece fits. The locking rim is slipped between the outer face of the main rim and the bead of the tire. Both beads of the tire rest on it.

Recesses are set in the outer edge of the main rim, and corresponding lugs are on the locking section. These lugs seat themselves in the pockets when the locking section is pushed into place, holding the tire securely.



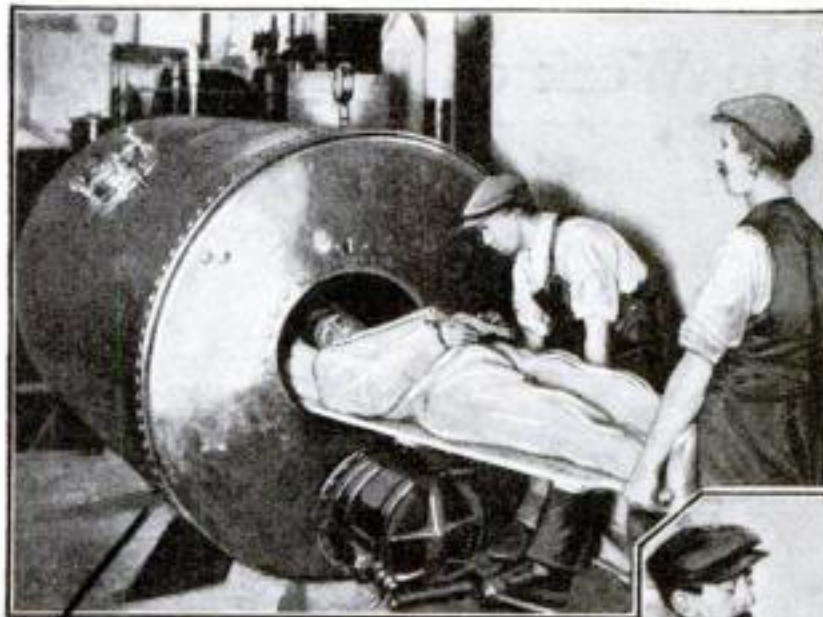
Fastening the tire with locking rim



Airplane "Hooks a Ride" on Army Dirigible

WHEN an airplane, flying 60 miles an hour, caught with a hook the lowest rung of a wire ladder suspended from the army dirigible D-3 at Langley Field, Va., recently, the dream of a dirigible carrying fighting planes became reality.

Such a mother ship could carry planes as a defense, or for an aerial attack. The use of suspended rings on the dirigibles, instead of ladders, has been proposed. The dirigible would carry supplies for the planes and furnish quarters for their men.



At the left: Demonstrating the use of a compression chamber, into which a diver who has come up too quickly from a great depth is placed to prevent the dread caisson disease

Below: A student diver donning a diving helmet for a plunge into the training tank at London, Eng.

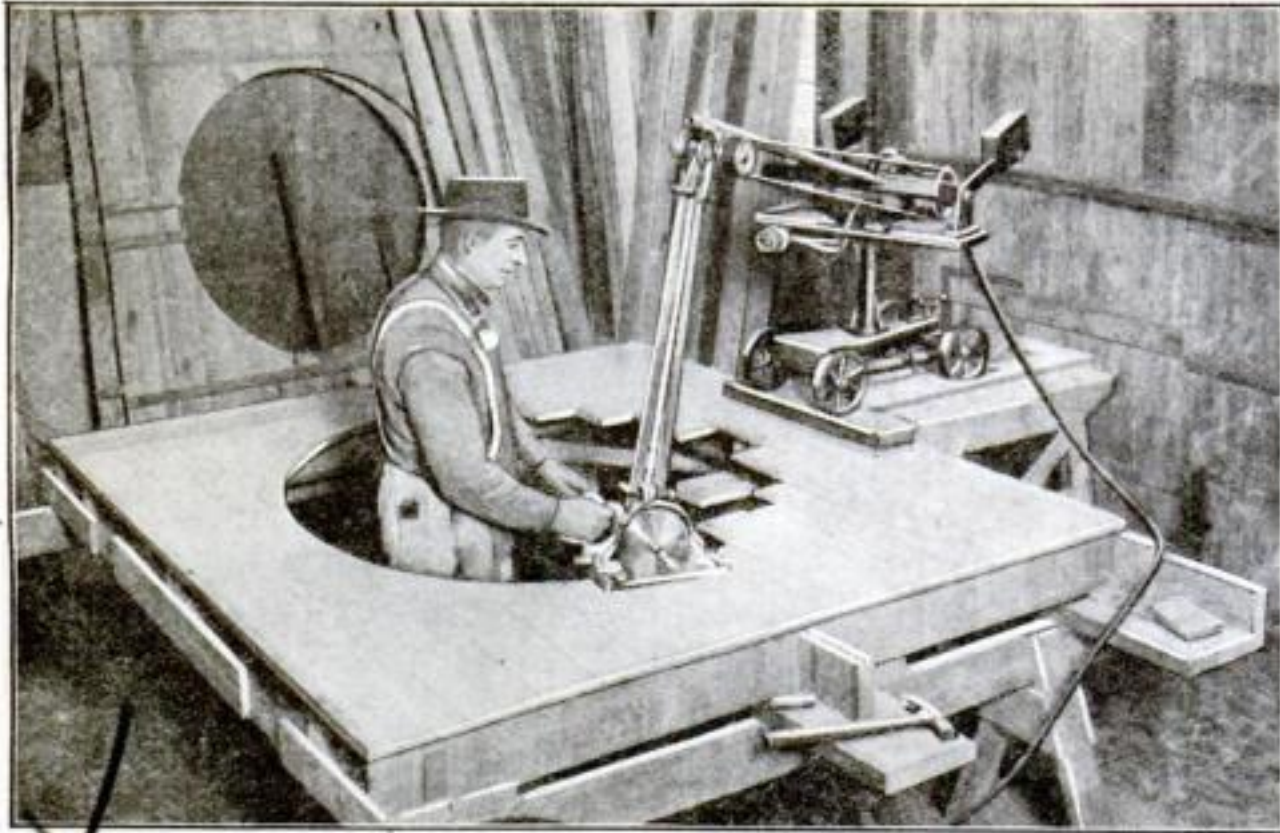
Deep-Sea Divers Go to School in a Tank

HUNDREDS of divers employed since the war in deep-sea salvaging operations have been trained scientifically in an enormous tank built by a firm of salvagers in London to duplicate actual conditions encountered under water. In this tank they are given a complete course that is said to fit them for any diving feat they may be called upon to perform.

The equipment of the training school includes a compression chamber. Sometimes divers coming up too quickly from great depths are attacked by a type of paralysis called "caisson disease," or the "bends." This often proves fatal unless instantly treated.

The afflicted man is put into a compression chamber under a pressure equal to that of the lowest depth to which he has been just before the attack. The pressure then is decreased gradually.





Portable Electric Saw Cuts Inside Circles

A VERSATILE and portable electric woodworking saw, embodying features hitherto said to have been found only in stationary mill saws, is now offered builders and manufacturers. It is claimed to be particularly useful in making forms, or in mortising, drilling, and planing. It will cut, measure, and square or bevel form ends.

The machine is mounted on a four-wheel carriage with roller bearings, the

swivel post being carried on ball bearings. The sawing head is adjustable to cut any angle up to 55 degrees, a feature adapting it particularly to the cutting of jack rafters, as well as joists, studding, bridging, siding, and flooring. A radius rod, adjustable to different sized circles, permits the cutting of circular holes. The illustration above shows such an inside circle being cut for a column head form.

Coal-Miners Ride to Work on Railway Cycles

FOOT cars—one-man cycles with flanged wheels for riding on a railroad track—carry the employees of a West Virginia coal mine to work. By long odds the most direct route between the town where the miners live and the mine is this railroad line. The perfection of these unique carriers is said to have saved the workmen nearly an hour a day. They are pedaled, the sprocket driving the rear wheels.



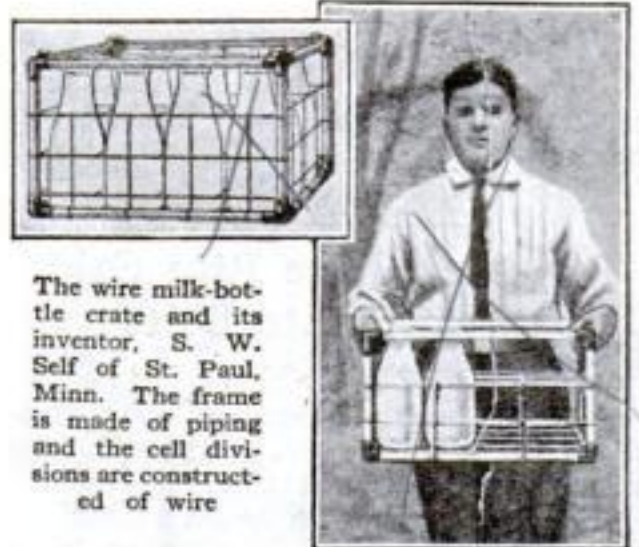
West Virginia miners riding to work on four-wheeled cycles

Sanitary Crate for Milk Bottles Made of Wire

A NEW milk-bottle crate for which are claimed the advantages of lighter weight, greater capacity, better sanitation, and longer life, has been invented by S. W. Self, a dairy worker of St. Paul, Minn.

The crate now generally used is of wood, has solid sides and weighs from 13 to 18 pounds. The new crate, with a frame of piping and compartment divisions of galvanized wire, is said to weigh only eight pounds and to allow instant inspection of its contents. The pipe frame provides a handle all around the top, instead of the small slots or depressions that serve as hand grips at the sides of the usual wooden crate.

Since neither the galvanized wire nor the piping can become water-soaked, rusted, or easily worn out, the inventor believes the new crate will save many thousands of dollars for the nation's dairies.



The wire milk-bottle crate and its inventor, S. W. Self of St. Paul, Minn. The frame is made of piping and the cell divisions are constructed of wire

How to Keep Doors from Sticking in Dampness

FOR the householder who would avoid the nuisance of doors that stick in moist weather, the United States Forest Products Laboratory at Madison, Wis., points out the importance of painting or varnishing the tops and bottoms of doors—places often neglected because “they don’t show.” These hidden edges, if not painted, are vulnerable points where the wood absorbs or loses moisture rapidly, especially at the ends of the outside uprights where the wood grain is exposed.

HOW MUCH DO YOU KNOW ABOUT SCIENCE?

1. Will the brain work better in a warm room than in a cold one?
2. Why do flowers smell sweeter after rain?
3. Is there such a thing as a “criminal face,” a “criminal mouth”?
4. How are storms predicted by meteorologists?
5. Why is it that certain diseases afflict a person only once?

ONE sure way to gain confidence in yourself is to understand the forces that move the world and the every-day things about you. Constantly situations arise in which ignorance of simple, yet vital scientific facts may place you at a disadvantage—even humiliate you. Knowledge of these facts, on the other hand, enables you to think, speak, and act with authority and confidence.

Our monthly science questions, culled from thousands asked by our readers, offer you the roots of an invaluable habit, that of adding steadily to your store of knowledge.

Do your best with these questions, then turn to page 157 for the correct answers.

6. Why is the sky blue?
7. Are there any lost arts?
8. Why does an electric current cause death?
9. What is the will-o'-the-wisp and how is it formed?
10. How can you make fresh water from salt water?
11. What is the largest snake in the world?
12. What makes the colors of precious stones?

Top of Gearshift Lever Serves as Pistol

A DETACHABLE pistol top for the automobile gearshift lever is a new invention for protection against highwaymen. By drawing back a slide with the thumb, a section of the lever is loosened. Withdrawal of this section from its position on the end of the lever automatically cocks the pistol. Pressure on a trigger permits the operator to fire two shots in less than a second, it is claimed, without attracting attention by his movement.

Since the lever is within easy reach of the driver, he has an immediate means of defense in an emergency.



Releasing the pistol grip of the lever

Collapsible Wheelbarrow for Women Farmers

IN GERMANY where, since the war, women have done much of the farm work, a light, collapsible wheelbarrow has been invented. It can be carried about easily.



The wheelbarrow in use and collapsed

How Northern Railroads Battle Snowdrifts

SNOWSTORMS are serious matters on railroads of Alaska and the Pacific Northwest. Unless prompt and vigorous measures are taken, a line may become so completely buried that only the warm winds of spring can release it. Henceforth the Copper River & Northwestern Railway will be armed with a remarkably effective new winged type of snow plow, the recent invention of Charles Dustin, one of the road's master mechanics.

A locomotive with a stout nose-type plow pulls a car equipped with a steel arm 18 feet long and tapering from four feet at the car end to 2½ feet at the tip. This may be set at any angle horizontally or vertically by levers controlled by the operator. Two compound engines, supplied with steam from the locomotive, furnish the power.

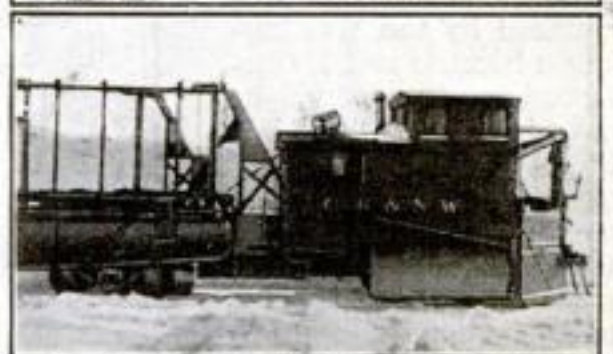
The plow on the locomotive piles the snow on both sides of the track. The steel wing then cuts down the tops of these banks, the snow gliding along the smooth, curved arm and dropping between the rails. A rotary plow follows, scattering this snow far from the roadbed. Thus high, collapsing piles are avoided.

Snow plows used on northern lines in the United States are of two general types. One, used for lesser accumulations and on comparatively straight stretches, has wings that curve out concavely, flinging the snow to both sides. The other is rotary, with blades that hurl the snow at right angles in a circular cloud. These rotary plows are more redoubtable fighters and can operate on the curves and steep grades of mountain stretches, plunging through high drifts and scattering them to the side of the tracks. The other type requires too much head-on power to do this.

Miners Guided by Smoke

MEXICANS working in a lead mine in Chihuahua, Mexico, have found a new use for cigarettes. The mine consists of a series of caves, along the sides and bottoms of which lead and silver ores in paying quantities are found.

The miners have noticed that smoke from their cigarettes is sucked through cracks in the rocks at certain points. By drilling in the wake of the smoke, they find another cave. This method of tracing ore was followed through many caves.



Top: Rotary plow in action. Center: View of blades. Bottom: New wing type plow

Ingenious Foot Plow Is Hauled by Man Power

LEG-POWER plowing is accomplished by the ingenious but muscle-tiring apparatus invented in Germany and pictured below.

Pressure on a foot lever lifts the nose of the device, while a toggle joint causes the nose to be dropped a short distance ahead of its former location. The operator then pushes forward on a bar that pulls the plow a distance equal to the forward movement of the nose.



Hand and foot levers drive the plow

Pathfinders and Their Work

New Discoveries that Add to Our Useful Knowledge

The amazing structure of the world's scientific knowledge is built of an infinite number of units—never-ending contributions from the busy minds of inquiring men and women. On this and the following page you will read of discoverers who are increasing the sum of science for our profit

The Language of Animals

ARE dumb animals really dumb? Have they not, on the contrary, some way of communicating with one another that is beyond the power of man's senses to discern? Scientists long have puzzled over this question, and the theory has been advanced that animals—birds and insects too—communicate by uttering sounds with such rapid vibrations that the ear of man cannot detect them.

A way of putting this theory to the test was developed recently, it is announced by the Westinghouse Electric and Manufacturing Company, in the invention by Dr. Phillips Thomas of an electric ultra-audible microphone, said to pick up sound vibrations that are much too rapid for the ears to hear. Besides promising to solve the secret of animal "speech," this instrument is said to have immediate practical value in permitting perfect voice transmission by radio or the telephone. Sounds heard through a radio or telephone receiver differ now from the sounds that enter the transmitter because the instruments are incapable of recording the more rapid sound waves.

Stimulating Plants

POPULAR SCIENCE MONTHLY told last month how science has put plants on the night shift, making them grow 24 hours a day by installing powerful electric lights in greenhouses. Now science is stimulating plants by drugs. Professor David Lumsden, of the Federal Horticultural Board, has discovered that the growth of various plants can be stimulated by ether, which may be inhaled by the plant or injected by a hypodermic needle.

While ether puts man to sleep, it is said to exert an entirely opposite effect on plants, even reviving them when apparently they are dead. Thus frozen rose plants are said to have grown green shoots in a few hours after a single "shot" of ether, and to have thrived remarkably thereafter, resisting plant diseases.

Electric Lamp Lighted by Radio

THE wireless telephone has girdled the earth. Will there be a similar development in the wireless transmission of electric power? It is the next step in the

radio world of 1924, for a beginning has been made that is quite as startling as the wireless signaling experiments of 30 years ago. Dr. Willis Rodney Whitney, of the General Electric Company, a few weeks ago lighted a 110-candlepower incandescent lamp by power transmitted by radio.



DR. NIELS BOHR, of the University of Copenhagen, winner of the Nobel prize for physics in 1922, is gaining increasing world recognition for his important discoveries of the nature and structure of atoms. At the recent meeting of the American Association for the Advancement of Science, his theory concerning the worlds and solar systems that lie beyond the range of powerful microscopes, was declared by scientists to be one of the most useful scientific tools ever placed in their hands for work of research and discovery.



MME. CURIE, co-discoverer of radium, lives not only to enjoy the highest honors bestowed on her by the President of France, but to see her great work carried on for relief of cancer sufferers. Simultaneously with the recent Paris celebration of the twenty-fifth anniversary of the discovery of radium, was held a ceremony inaugurating the Curie Foundation, an institution recognized as a public utility for consultation and treatment of all cancer patients, rich and poor alike, who turn to radium for aid.

Psychology and Education

BY ITS application to industry in late years, psychology has demonstrated its usefulness, recently declared Dr. Herman P. Shearman, professor of economics at Miami University. And psychology applied to education will cause a revolution in education within the next 50 years, he added. In other words, according to Doctor Shearman, "after having devoted itself during the last century to the arts and to industry, science is now turning its attention to the primary forces of all, the forces of the mind."

Conquers Disease

SINCE the war the famous British pathologist, Sir Almroth Wright, has been seeking a cure for septicemia, a dangerous blood disease. At last he conceived the idea of performing a new sort of blood transfusion by extracting the blood of a healthy person, inoculating it with an anti-septicemia vaccine and injecting it in the veins of a sufferer.

Recently it was announced that this method had proved remarkably successful. Thus another disease is yielding to transfusion—a method now used in the control of almost 30 maladies.

Bird Sex Changed

TWO amazing instances of a complete change in sex in full-grown birds were reported by scientists a few weeks ago. Dr. Oscar Riddle, of the Cold Spring Harbor, N. Y., experiment station of the Carnegie Institution, told of a female dove that had become a male dove after groups of cells had been destroyed by a tubercular infection, then regenerated by nature.

A somewhat similar case is that of a Buff Orpington hen in the animal breeding research department of Edinburgh University, Scotland, which, after the age of three years, ceased laying eggs and took on the appearance and habits of a male bird of the species. These cases are regarded by scientists as being of enormous biological importance. They indicate, it is said, that the modification and control of bodily and mental characteristics in animals await only definitely directed efforts of scientific investigation, since no characteristic appears definitely fixed.

To scientists who witnessed the demonstration it was an event comparable with the beginnings of wireless telegraphy.

What Is the Earth Made Of?

MANY theories have been offered regarding the composition of the earth. The latest, as presented by Dr. E. D. Williamson and Dr. L. H. Adams, scientists of the Carnegie Institution of Washington, is as follows:

A small core of gold, platinum, and other metals heavier than iron. Around this, a 4200-mile sphere of iron or an alloy of iron and nickel. Next, a mixed layer of iron and rock, extending to within about 900 miles of the surface. Then a layer of rock. Covering this a surface crust, about 35 miles thick, consisting mostly of granite. These statements are based on a study of earthquake waves.

in the Progress of Science



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DR. J. HARRIS ROGERS, discoverer of underground and under-sea wireless, is shown above surrounded by radio experts, listening in for messages from London in the laboratory of his home at Hyattsville, Md.

From left to right, in front, are: G. E. Oliver and W. L. Lesch, radio experts of the Radio Corporation of America; Dr. T. E. Latimer, personal physician to Doctor Rogers; Dr. J. Harris Rogers; W. B. Flaherty, Western Union radio engineer of Washington; A. C. Doyle, Radio Corporation of America; D. H. Beatty, safety expert



DR. H. C. GORE, of the Bureau of Chemistry, United States Department of Agriculture, with the experimental apparatus by which he has discovered a method of converting corn into sugar, imitating the processes of the human stomach. He claims to get 33 pounds of sugar from a bushel of corn, converting all the starch contained in the corn into an equal number of pounds of sugar



*Prof. E. Branly
Paris, France*



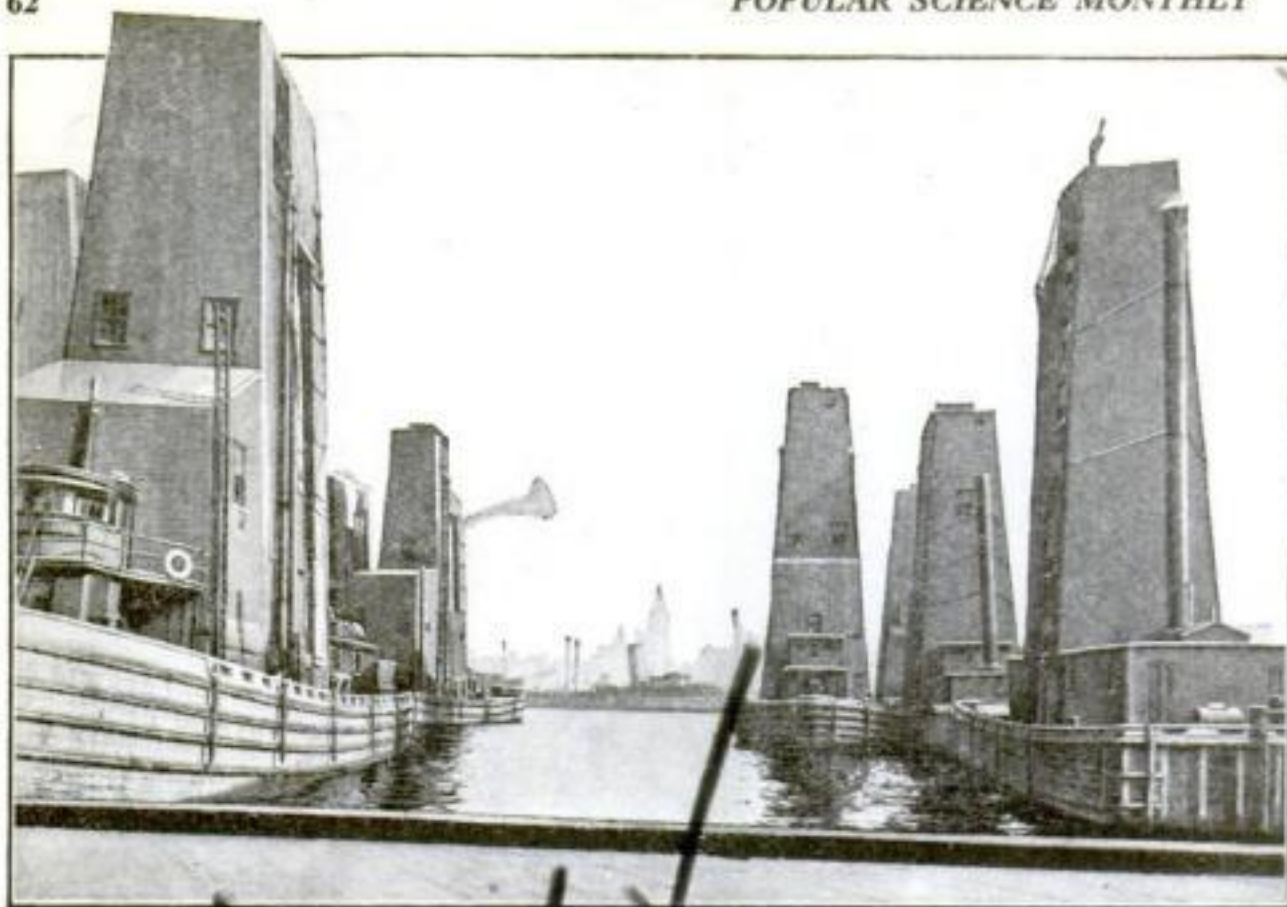
*Dr. D. W. Morehouse
Drake University*



DR. CLARENCE N. FENNER, volcano expert of the Geophysical Laboratory of the Carnegie Institution of Washington, D. C. After a daring descent into the steaming crater of Mount Katmai on the Alaskan peninsula, he has returned to Washington with valuable new scientific data on volcanic phenomena. He is shown above examining specimens of rock crystals found in the crater

PROF. EDOUARD BRANLY, noted French scientist, who, by his invention of the coherer, made possible the experiments of Marconi and the realization of telegraphy without a connecting cable, recently received recognition from the French government by being made a Chevalier of the Legion of Honor. Professor Branly is 80 years old, yet he still works in his laboratory in Paris where he made his important discoveries. Above is a recent portrait

DR. DANIEL W. MOREHOUSE, acting president of Drake University, Iowa, and a leader in astronomical research in America, announced a short while ago that he had discovered a new nebulous star, remarkable for the phenomenal amount of star dust—particles of matter falling through space—that surrounds it. His observations have been verified by Dr. Harlow Shapley, noted astronomer, director of the Harvard University Observatory



Huge Floating Elevators Load Grain Ships

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THESE floating elevators in the Hudson River at Jersey City, N. J., represent the most modern method of transferring grain at tidewater terminals.

They are said to effect enormous economies over the old methods.

From the towering elevators the grain is loaded into ships by gravity.

Mechanical Stump Puller Anchors Itself

A STUMP puller that carries an anchor and an extra weight, and therefore need not be anchored to tree or stump, is a new invention for reclamation of waste lands.

The machine has three wheels and practically all its weight is so located as to counterbalance the pull of the cable. A heavy axle passes through the two rear wheels and supports the frame, into the rear end of which is built the anchor. Pivoting the frame over this axle forces the anchor blade to plow into the ground while

the machine is pulling at the stump.

Additional anchoring weight is hung from a boom held by guy wires from the frame.



How the powerful machine anchors itself while pulling a stump

Seaplane Carried on Deck of Submarine

ON THE deck of the United States submarine MS-1 are housing facilities for a seaplane. The hangar is a tank-like room into which the plane is stowed after the wings and pontoons have been

demounted from the fuselage. Within a very few minutes after the submarine has reached the surface, the plane can be re-assembled and launched over the side of the submarine.



The U. S. Navy submarine MS-1, showing seaplane ready to be launched from its deck

Motor Drives Blades of Horse-Drawn Mower

A MOTORIZED mowing machine, invented by Robert C. Chattin of Mountainhome, Tenn., is drawn by horses, while the mowing blades are driven by power. Power is furnished by an internal combustion engine operatively connected with the cutting blades.

This machine is said to perform the work of two horse-driven sickle or mowing machines and in a more satisfactory manner.

The cutter mechanism is operated at a uniform speed. The weight of the entire machine is supported by the frame that is balanced so that the horses are relieved of practically all the load, conserving their strength for pulling the apparatus.



The mower with power plant

New Vise Grips Irregular Object like a Hand

A VISE that grips irregularly shaped objects with the adaptability of a human hand is an important recent mechanical development.

The vise jaws, individual pivoting semi-circular segments, are said to adapt themselves to the contour of an irregular object without packing, holding it absolutely rigid. This even distribution of gripping pressure is designed to eliminate the danger of distortion when holding thin-walled objects, as automobile cylinders, or long and narrow work. The vise is tightened by pressure exerted on the vise handle.



The jaws gripping an irregular piece

Another important feature is that the jaws, once fitted to a shape, can be tightened with screws to maintain the same relative positions. Thus, in machining a quantity of objects of the same shape and size, the vise will serve as a special fixture, holding each piece in the same position as every other piece.

A LUNAR rainbow in the form of a complete arc was observed recently during a shower at Sanderstead, Surrey, England. The moon was shining in a portion of the sky that was for the moment cloudless.

Villages Wrecked to Build 16,000-Acre Reservoir

SIXTEEN thousand acres in the Pawtuxet River valley, R. I., are being stripped of villages, factories, roads, churches, schools, and cemeteries so that the city of Providence may have a 36,900,000,000-gallon reservoir.

For eight years hundreds of workmen have labored to transform this wide landscape. Steam shovels have bitten away at huge hills. Great mushrooms of sand and rock have been hurled high into the air, and trainloads of sand and rock have wound in and out among the hills. Yet three more years will be required to complete the vast project.

A Thousand Buildings Demolished

Most of the 1195 buildings condemned already have been torn down. Of these, 375 were dwellings, seven schools, six churches, and six mills. Thirty-five miles of highways will have to be relocated. The remains in the 173 burying grounds are to be reinterred elsewhere.

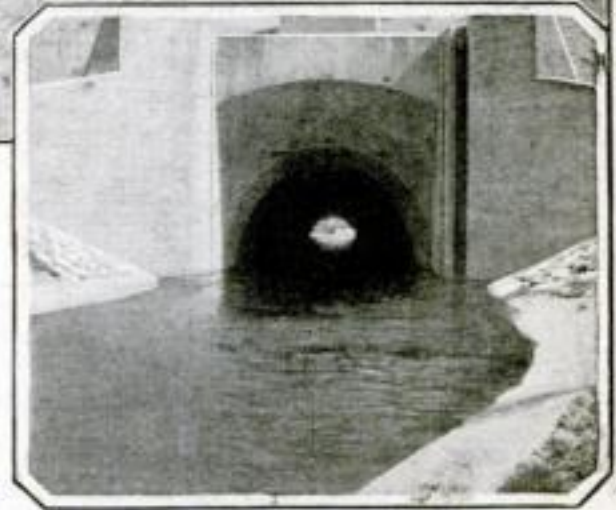
The site of this monster reservoir is at Scituate, about 10 miles from Providence, at a point where the valley of the Pawtuxet River huddles between towering hills. By digging away the lesser hills in the basin and allowing the high hills to serve as the shoreline, the engineers can build a dam and have an enormous basin. This main dam stretches 3200 feet from one side of the valley to the other. In some places its foundation is carried 80



Digging to rock bottom for a solid foundation for one section of the main dam

feet down into solid rock. Across its top will run a wide boulevard. The dam will be 118 feet thick at the flowline and will have a 413-foot spillway. At its base it will be 640 feet thick.

At a cost of \$280,000, the river's course was altered to facilitate the construction. One contract alone—that for constructing the main dam—amounted to \$3,500,000.



How the Pawtuxet River is diverted through a tunnel under the site of the dam

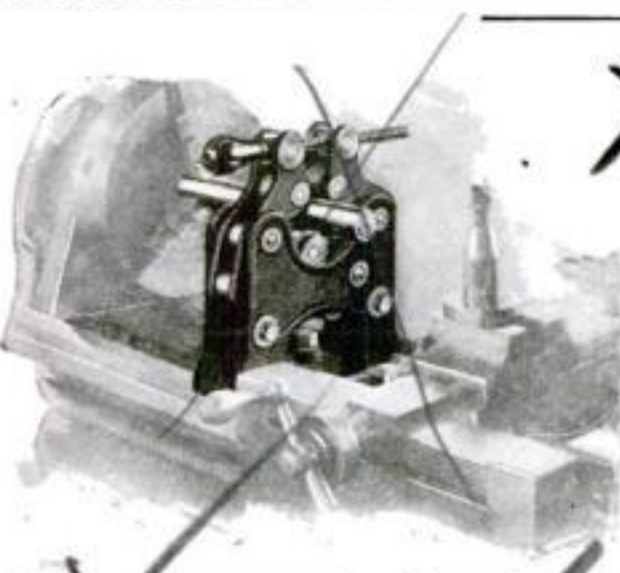
Testing the Balance of Revolving Machinery

A BALANCING machine, designed for correcting the dynamic balance of machine parts in manufacture, thereby eliminating vibration in the assembled product, has been placed on the market by a Wisconsin concern.

The piece of machinery to be tested is placed in rollers in the carriage and fastened to the headstock. This headstock and the flywheel to which it is attached are turned by an electric motor. Centrifugal force tends to pull any unbalanced

masses away from the axis of rotation, causing the piece of machinery under test to vibrate back and forth as it is turned. These vibrations are transmitted to a recorder by means of a string. When there are no vibrations, the piece of machinery is perfectly balanced.

In addition, the amount of unbalance and the location of the heavy parts are determined mathematically by two tests of rotation, the necessary correction being recorded on a dial and vernier. The machine is adapted to a wide variety of work, including balancing crankshafts, flywheels, rotors, pulleys, and other revolving parts. It will receive bodies up to 24 inches in swing and 32 inches between bearings.



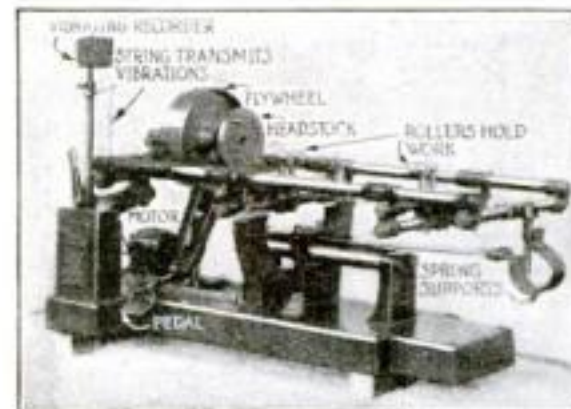
New Automatic Steadyrest for Machine Work

A NEW automatic steadyrest that will hold a piece of metal secure to permit a machinist to perform such operations as boring, facing, and turning at the end of the piece, has been developed quite recently by a well-known Pennsylvania manufacturer.

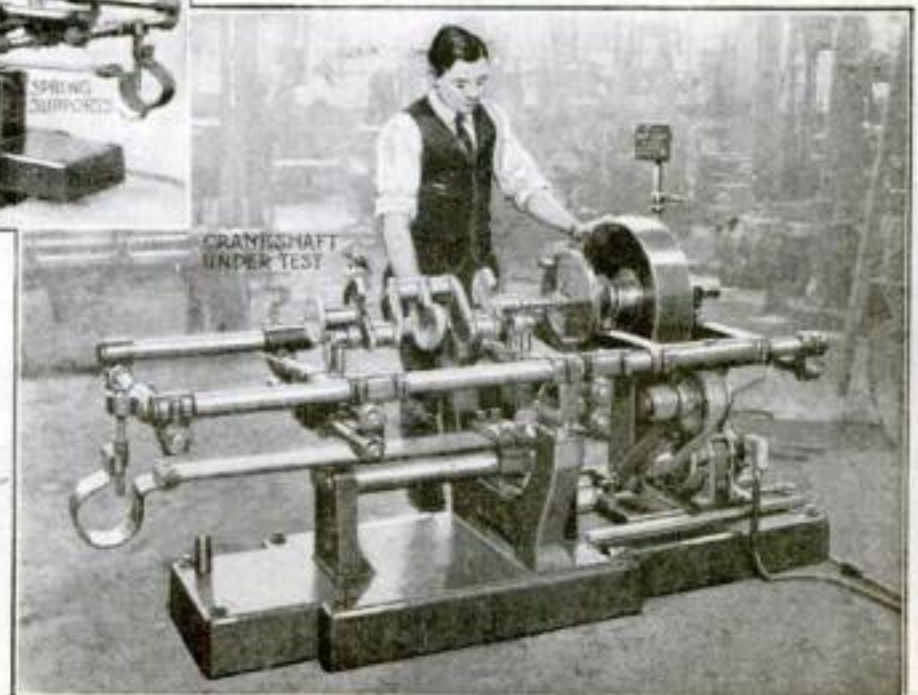
The work is inserted from the top, and when the jaws are closed, is held by three rollers that revolve toward the center. When the work is in place, the handle end of the adjusting screw is dropped into a slot and the jaws are tightened by turning the screw.

The device may be attached easily to the lathe or removed, it is claimed. When once adjusted for the required purpose, no further alteration is necessary until a new job is handled.

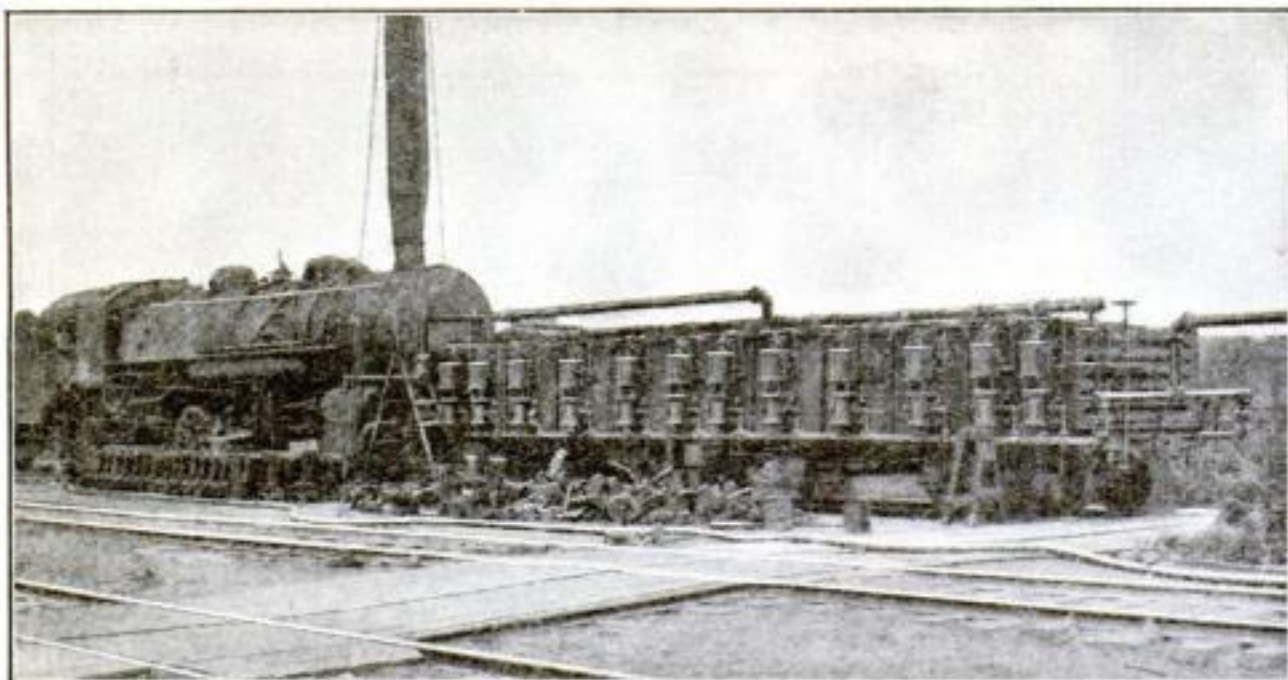
Stock of many sizes may be handled with no adjustment of the apparatus besides a few turns of the tightening screw.



Above: The balance-testing machine, showing how a piece of machinery under test is fastened to headstock and revolved by an electric motor. Vibrations caused by bad balance are transmitted to a recorder by means of a string



At the right: Testing the balance of a crankshaft while in motion



Locomotive Turned into Pumping Station

WHEN the air pumps in the power house of an Indianapolis railroad shop blew a piston head, consternation reigned. New pumps could not be installed for several weeks, and without pumping facilities the men could not work. One of the engineers mastered the situation, and the serious cost of such a

shut-down was spared the shop and the men.

The air pumps of 24 locomotives were fastened to the sides of a coal gondola and supplied with power by a large freight engine. Within less than 24 hours from the blowing of the piston head, full pumping efficiency had been restored.

Trousers Pressed Quickly by Electric Valet

AN ELECTRIC valet which when attached to an electric-light socket, is claimed to press a pair of trousers in the time it takes a man to shave, is one of the latest of home electrical appliances.

It consists of three flat units—a top, base, and pressing pad. The pad is equipped with a thermostat that shuts off the current when the correct temperature has been reached, thus preventing overheating and scorching.



To press the trousers, the heating pad is dampened evenly on both sides with a moist rag. Then one leg of the trousers is spread out, smoothed and stretched on the base so that the cuffs extend over the edge. The pad then is placed over the leg and the second leg is placed on the pad. Over all the top is laid and fastened by clamps. Finally, the current is turned on.

It is claimed that only 12 minutes are required to press light summer trousers, and from 15 to 20 minutes for heavier trousers. The cost of one pressing is said to be about two cents.

Simple Door Guard Locks Key to the Knob

THE inventor of this simple doorkey guard claims that no burglar can push in the key of a door equipped with the device and insert his own. One end of the guard encircles the neck of the doorknob and the other end passes through the eye of the key. The key then cannot be turned nor pushed out by an unwelcome intruder.



How the key is locked to the doorknob

The guard is made in two models—one that can be opened and detached, the other permanently closed, requiring removal of the knob to detach the guard.

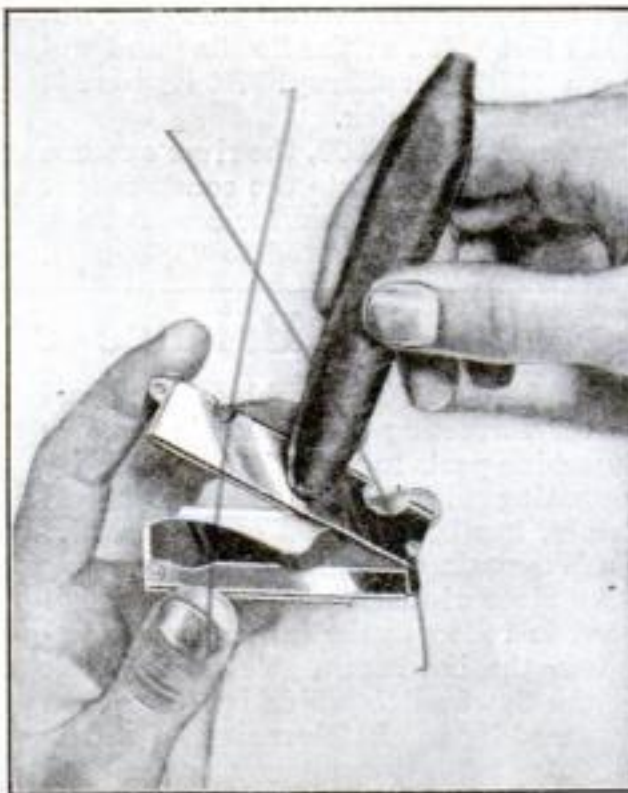
TO TELL whether fabric contains sizing to improve its appearance, boil a piece of the goods. This brings out the sizing.

Cigar Cutter and Knife from Old Razor Blades

OLD razor blades may be put to a dozen uses, it is said, by means of this handy pocket contrivance, designed to fit any make of blade. It folds like a jackknife, and is flat and thin, and therefore fits in the pocket without sagging or bulging it.

Besides serving as a pocket knife, it has a round opening placed so that when the knife is closed, the blade serves as a cigar cutter. Another opening is provided for cutting string on packages—often dangerous with an open blade.

A notch in the handle can be used as a handy bottle opener, while a pointed corrugated lever on the blade-holder serves as a nail file or match striker when the device is closed. Extending this lever supplies the user with a nail cleaner and a piercer.



Safety razor device used as cigar cutter

Hole in License Plate to Foil Thieves

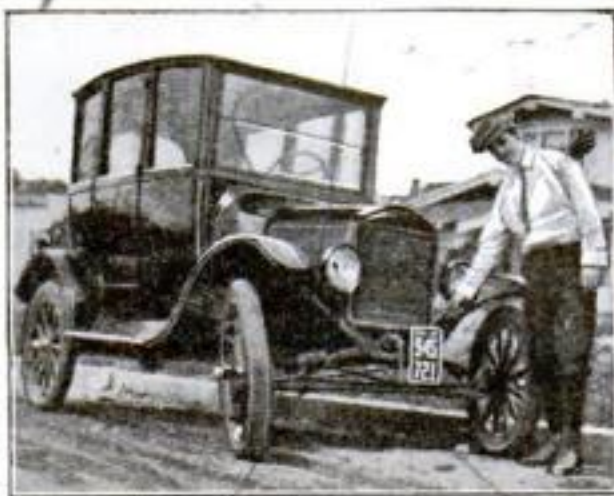
AN AUTOMOBILE license plate with a large square cut out would be almost certain to attract the attention of a policeman immediately. On this fact Jons Nelson, of Los Angeles, Calif., based his invention of a new anti-thief device.

An auto driver, when leaving his car,

detaches a rectangular section cut from the center of the plate, as shown below. When he returns, he inserts the missing piece. Both operations are simple and quickly accomplished. An electric alarm reminds the driver if he forgets to put back the missing portion.

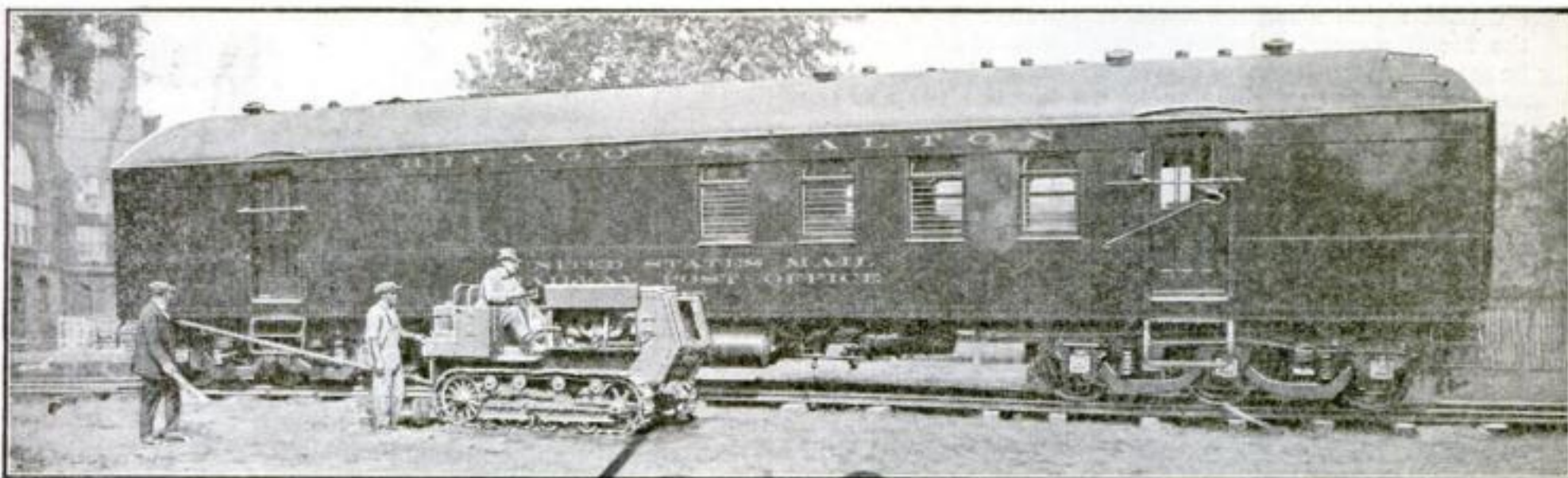


The theft signal plate with section removed



License plate with cut-out section replaced

Five-Ton Tractor Tows 160-Ton Railway Mail Car



A FIVE-TON endless tread tractor coaxed a 160-ton mail car over 400 feet of temporary track from the main line of the Chicago & Alton Railway recently

for exhibition at an Illinois fair. The ponderous load taxed the little tractor to the limit for four hours to accomplish the feat. A stout chain was made fast to the

rear of the car and the powerful tractor tugged alongside, pulling the heavy car like a tugboat towing an ocean liner into its waiting dock.

Would Dye Motor Gasoline Red for Safety

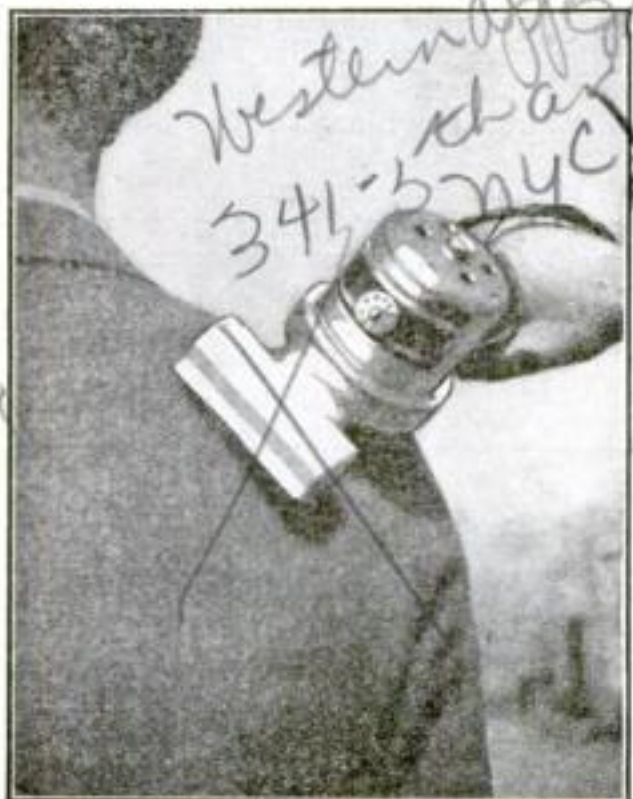
FOLLOWING a study of the hazards of gasoline, the United States Bureau of Mines has suggested that all motor gasoline should be colored red as a safety measure against mistaking it for water, kerosene, or other colorless liquids.

The Bureau has found that one ounce of dye is sufficient to color 1000 gallons of gasoline.

Midget Vacuum Cleaner Is Clothes Brush

A THREE-POUND vacuum cleaner that can be operated by one hand, has been invented for removing dust, lint, and ravelings from clothes, hangings, automobile interiors, upholstered furniture, and similar surfaces inaccessible to the usual full-size cleaner. A stiff brush attachment is provided for cleaning billiard tables, walls, and other solid, flat surfaces.

The device collects dirt and is emptied like the usual cleaner. It is said to exert ample suction for any of the purposes enumerated.



Vacuum cleaner used as clothes brush



Simple Home Shower Bath Is Easily Installed

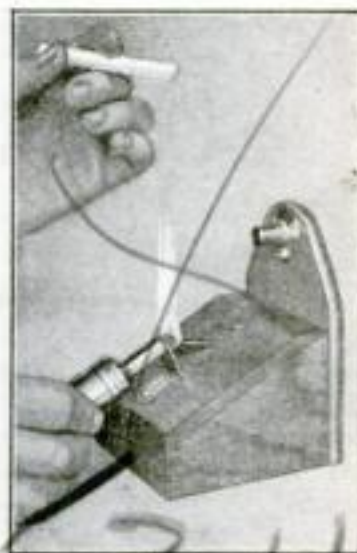
A HOME shower bath, usually considered a luxury, is said to have been made available at a cost far below that of built-in fixtures by a newly invented apparatus designed for use with a small gas water heater.

A foot control regulates the gas flow and hence the water temperature. Another model of the same device attaches to the faucet of a bathtub where one faucet discharges both hot and cold water.

Perforations in the lower half of the shower ring produce scores of tiny streams. There is a steady, generous flow over the whole body, yet the hands of the bather are left free. The hair cannot be wet, as under the ordinary shower.

Cigarette Lighter Uses Spark and Benzine

BENZINE and an electric spark are substituted for matches in this cigarette lighter. The tipped cylinder shown in the right hand holds a wick and benzine. When a light is desired, the tip is touched to two metal strips shown beneath the flame. A spark from a battery within the device lights the benzine-soaked wick at the tip of the cylinder.



Fume Masks for Painters

RESPIRATORS and rubber gloves are being adopted in England to protect painters from lead poisoning and other ills to which they are otherwise exposed in working with paints and varnishes.



Protected by mask and rubber gloves

Lantern Light Is Bait for Fishes

ON CALM nights along the shores of the Mediterranean, fishermen often may be seen using the light from lanterns to attract the fishes. Remaining in a shadow, they wait until the fishes come close enough to the boat to be harpooned with tridents.

Adopting the same principle, two French naturalists, M.M. Fage and Legendre, have devised an ingenious lantern to assist them in their zoologic researches by projecting light into the

water. It is designed to attract the millions of small fish and marine animals that infest the waters of certain regions, to illumine them so that they may be observed and studied in their native haunts. It works the same as the old-fashioned lantern but, of course, is more efficient.

The lamp consists of a six-sided box with six windows. This box is about 18 inches high and is suspended from a circular float 27½ inches in diameter. On top of the lantern is mounted an acetylene gas generator, from which the gas is conducted to a burner tip near the bottom of the box.

Two boats holding a net between them can surround the space in which the lantern floats and capture all the fishes, large and small, that have been attracted by the light. It is possible also to float the lantern near the shore and attract the fishes that remain near the beaches. In this way a dragnet can be used to haul the fish ashore.

The use of acetylene is especially advantageous because water is the element that produces the gas. Thus, even if the generator is completely submerged, it will cause no harm. Instead of using a cork buoy the float may be built of metal, making the air chamber watertight.

The apparatus, it is said, can be used for both scientific and commercial purposes.



Light from the floating lantern attracts the fishes



Speeding Machinery Made to Appear Motionless

MACHINERY speeding at many thousand revolutions a minute, can be made to seem motionless or to appear to be moving at any desired speed, it is claimed, by a new electrical observation instrument called the rotostat. High speeds are thus made to yield to mechanical analysis.

The device is connected with a light socket and two knobs are turned until the machinery under observation appears stationary or moving at the speed desired by the observer. A lamp and reflector are mounted on an adjustable standard with the machine.

Errors in timing of interlocking parts, unexpected interference, deformation of parts under centrifugal stresses, and speed variations are said to be revealed clearly by the instrument.

The photograph above shows an observer studying the operation of a magnet wire insulating machine that is applying a double cover of silk to copper wire at a speed of 4000 r.p.m. He sees each wrap of silk as it is wound on the wire.

How to Photograph Panorama with Ordinary Camera

MOST amateur photographers will be surprised to learn that excellent panoramas can be photographed with an ordinary camera. The remarkably fine picture below is striking evidence that the feat is possible.

It was taken from the top of a 125-foot tower with a 2¼ by 3¼ folding camera and included approximately one quarter of a mile of lateral distance. Note how perfectly skyline, roads, and buildings match, attesting the astonishing accuracy of the method.

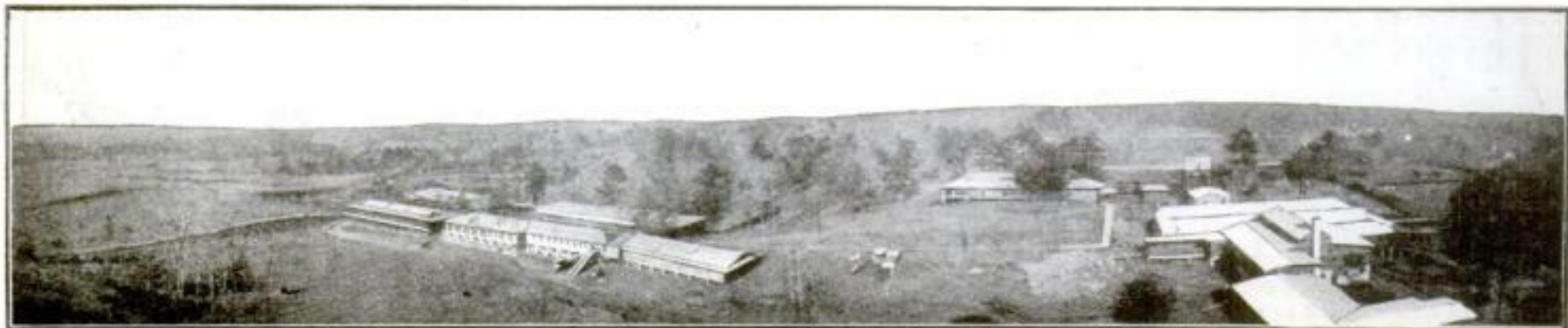
To take similar pictures you need, besides the camera, only a stationary tripod or some other object upon which the camera is mounted solidly while being permitted to swing from side to side. The regulation telescopic tripod is ideal for the purpose, since the thumbscrew may be loosened, allowing circular motion while still holding the camera firmly.

When the camera is in position, take an exposure of one extremity of the panorama desired. Now swing the camera, not the tripod, toward the center of the

panorama, allowing a tiny strip of the previous view to show in the view finder. Change the plate or film and make another exposure.

Succeeding sections of the panorama are made similarly.

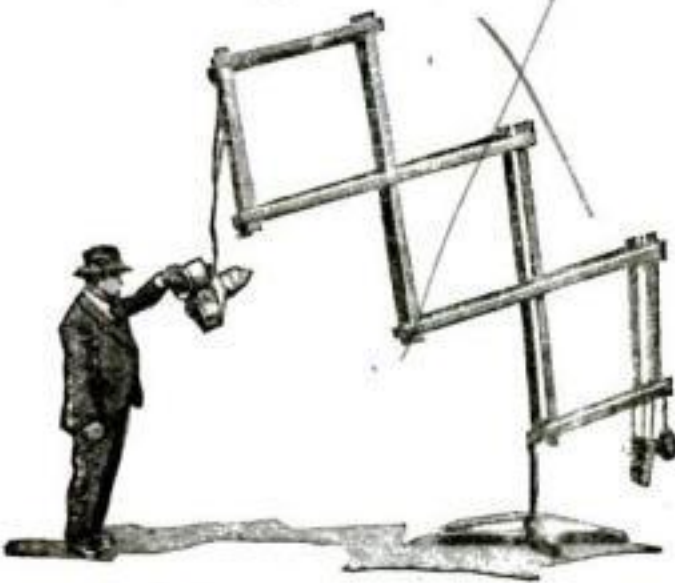
The films may be cut and matched when dry or separate prints can be made. For ordinary pictures, the regular stop and snapshot one fiftieth of a second exposure is sufficient. In views like the one below, it is best to use the smallest stop and short time exposure.



Lake Invents "Lazy Tongs" to Hold Heavy Tools

TO AID workmen in lifting and carrying heavy tools and other objects, Simon Lake, noted inventor of submarines, has devised what he calls a "gravity eliminator." It is a series of jointed levers—actually a "lazy tongs" mounted on a pivot, so that, when extended, the long end always will be twice the length of the short end.

From the short end is hung a weight sufficient to balance a cement gun, riveting hammer, air or rock drill, or whatever



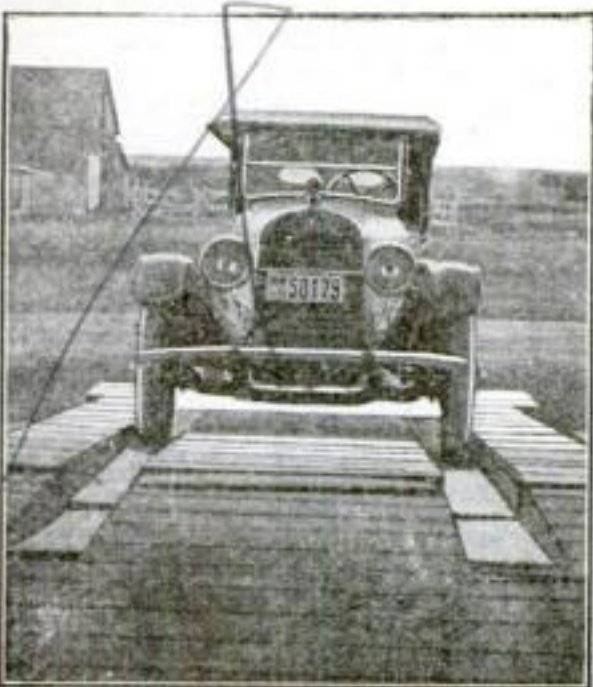
Simon Lake, famous inventor of submarines, demonstrating his "gravity eliminator"

heavy tool may be attached to the long end. The effect is that a tool that actually weighs 50 or 60 pounds seems to float in the air, relieving the workman of the muscular effort of supporting it.

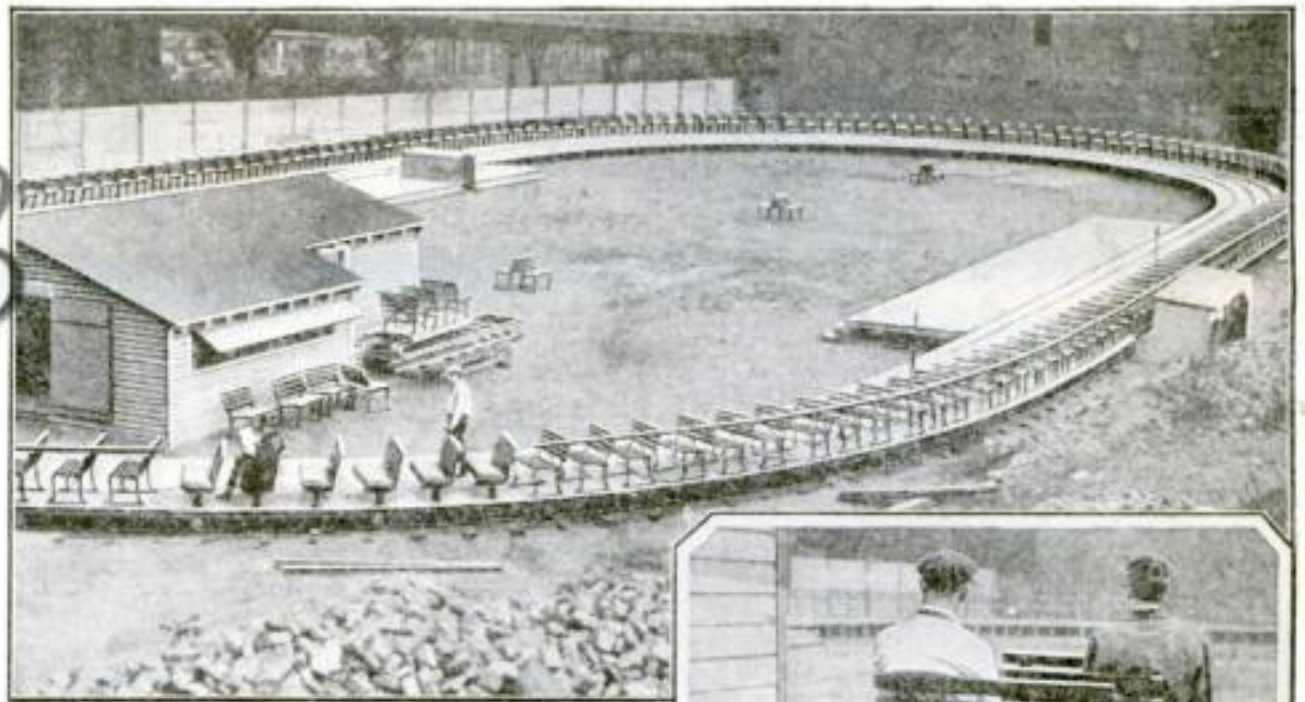
The extensibility of the device and the fact that it swings on a pivot give the workman a wide latitude of movement, says the inventor.

Garage Doors Opened by Weight of Auto

AUTOMATIC garage doors, recently perfected, are opened by the weight of a car as it approaches on a special runway. After the car has entered, counterweights close the doors. They cannot close while the car is on the runway or threshold, the inventor claims. Any sized garage can be equipped with the invention, it is said.



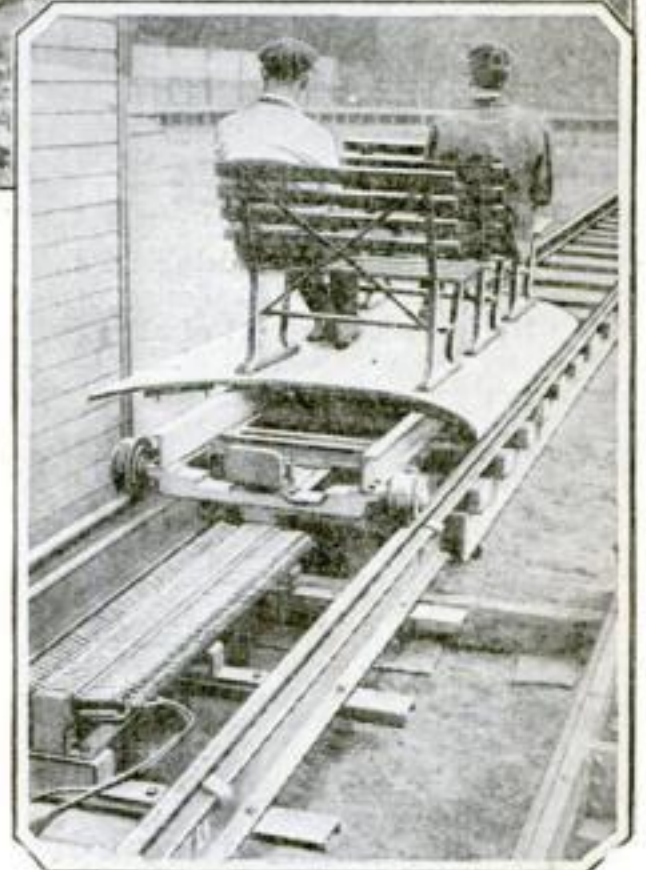
Weight of car on runway opens doors



Moving Walks Designed to Solve Traffic Problem

A UNIQUE three-speed moving "walk" soon may replace the shuttle subway trains that make the three-minute run between Times Square and Grand Central Station, in New York City. The pictures show a model being tested in a field at Jersey City, N. J.

The "walk" will consist of three parallel platforms running at three, six, and nine miles an hour respectively. It will run in a continuous loop. Passengers step from a stationary platform at each terminal upon the three-mile-an-hour platform, from this to the six-mile platform and thence to the last, upon which are seats. An electromagnetic power plant operates the carrier.



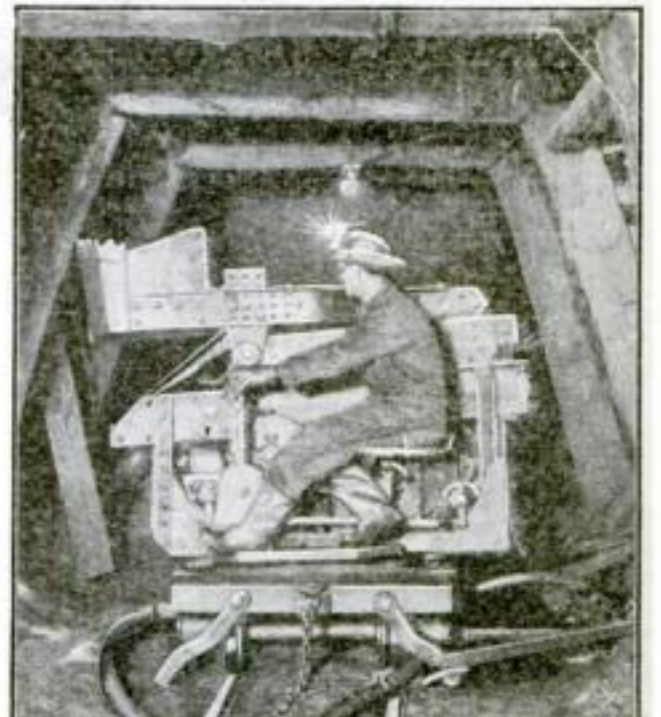
Above is a section of the model moving walk, showing the electromagnetic drive



Compressed Air Drives Midget Power Shovel

A COMPRESSED-AIR power shovel only 5½ feet long and operating on an 18-inch track is coming rapidly into use for work in cramped quarters, such as tunnel digging.

The shovel superstructure is carried upon a specially designed ball bearing. The swinging engine is vertically mounted and swings the shovel through a complete circle. No clutches are used, the engines being reversible while running at full speed and controlled by operating levers.



Compressed-air shovel operating in tunnel

Realistic Ocean Breezes from Vacuum Cleaner

OCEAN breezes, or at least deceptive imitations of them, are said to be obtainable from the household electric vacuum cleaner at about two cents an hour.

The bag and driving belt of the cleaner are removed and a sponge soaked in salt water is placed in the suction end. The effect of sea cliff breezes is heightened by placing the converted vacuum cleaner in an open window.

A NEW preparation to prevent clouding of auto windshields, perfected by the Navy Department, consists of a sodium salt of sulphonated rapeseed oil, with an excess of caustic soda and a small amount of waterglass, glycerin, and engine oil.

Where Acres of U. S. Destroyers Rust in Navy Yard



THIS remarkable view of the League Island Navy Yard, Philadelphia, Pa., shows how more than 100 destroyers, built by Uncle Sam at a cost of about a

million dollars each, lie huddled along the docks like sardines, gnawed by the elements.

Rusting beside them is a row of nine

battleships, a number of Eagle boats and other wartime auxiliary craft. The government has advertised many of them for sale. Those not sold will be scrapped.



Taking Dictation through Office Loudspeaker

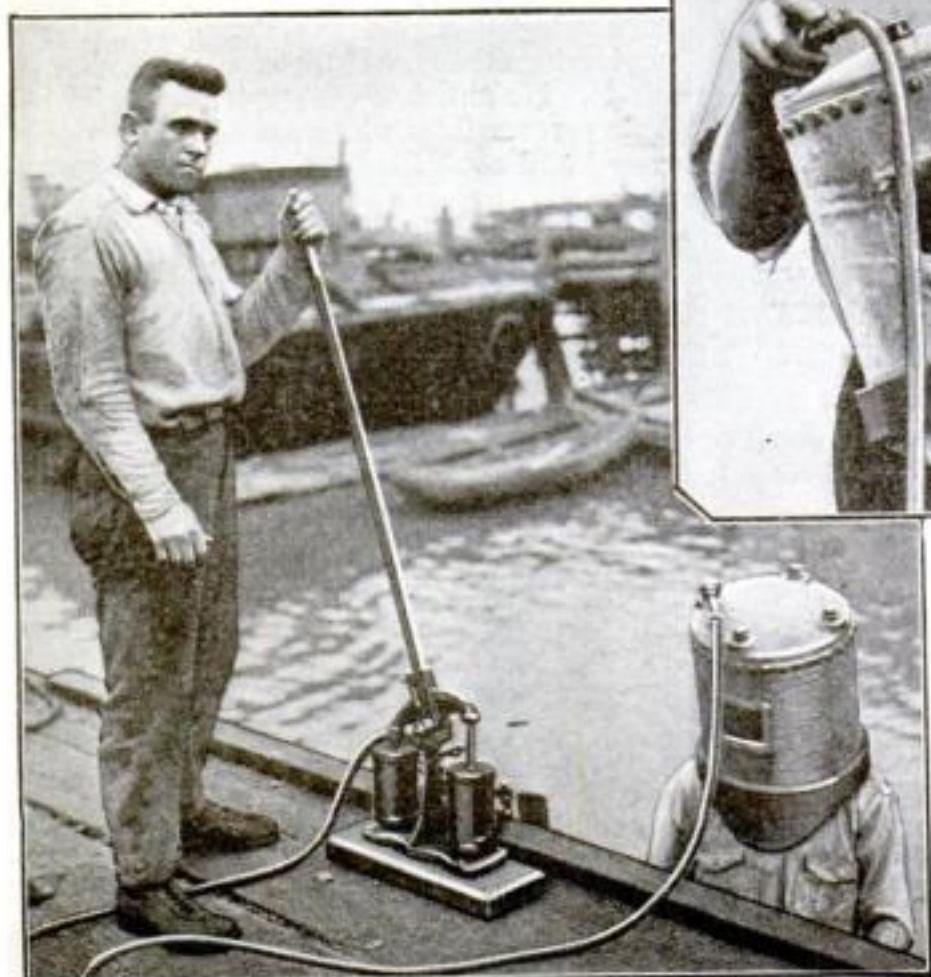
TAKING dictation from a loudspeaker is one of the new experiences of the stenographer in a modern office. The business man who is dictating the letter sits in his office in another part of the building and speaks into a telephone transmitter. The loudspeaker carries his words clearly to the stenographer, who transcribes them—a method that saves time all around.

Builds Novel Diving Suit from Old Boiler

IMPROVISING a diving apparatus from an old household hot-water boiler, 15 yards of rubber tubing, a length of heavy chain and a discarded beer pump, Walter Merwin, of Perth Amboy, N. J., has become a successful commercial diver.

He is the submarine member of a firm that salvages metal junk from vessels about to be scrapped. The inventor claims he can make deep dives with this rough-and-ready "suit," and that his homemade outfit is safe enough for him.

Walter Merwin and his ingenious diving helmet made from an old boiler



At the left Merwin is shown submerging for salvaging operations, using his odd homemade diving apparatus. Note the old beer pump used to supply air to the helmeted diver through 15 yards of rubber tubing. Note also the window cut in the side of the old boiler



New Piano Keyboard to Simplify Fingering

THE keyboard of the modern piano is an unaltered heritage from the instrument of several centuries ago. Novices and virtuosos alike have been aware of its limitations for fingering, but seem always to have reconciled themselves to it.

Now, at last, the straining, athletic fingers can relax, according to Dr. Moriz Stoehr, professor of bacteriology at Mt. St. Vincent College, New York. He has invented a scientific keyboard, with which, he claims, novices may save many of the weary hours of finger exercises. He also claims that pianists may create tonal beauties heretofore impossible.

The only visible difference between the new keyboard and the conventional one is the shorter length of the black keys. These do not extend all the way back to the fallboard, as in other keyboards, and the white keys widen to full width again behind them. This makes available a second row of white keys.

The new keyboard can be installed in a standard piano in a day, without structural changes in the instrument, the inventor asserts.

Radio Tubes for Autos

THE automobile engineer has added the vacuum tube, the miracle worker of radio, to motor-car equipment.

With vacuum tubes to control the ignition, the timing of the spark and its duration is said to be controlled accurately without the usual complicated adjustments necessary with present types of generators and interrupters, and without constant adjustment to counteract the effects of wear and tear on interrupter contacts and mechanism.

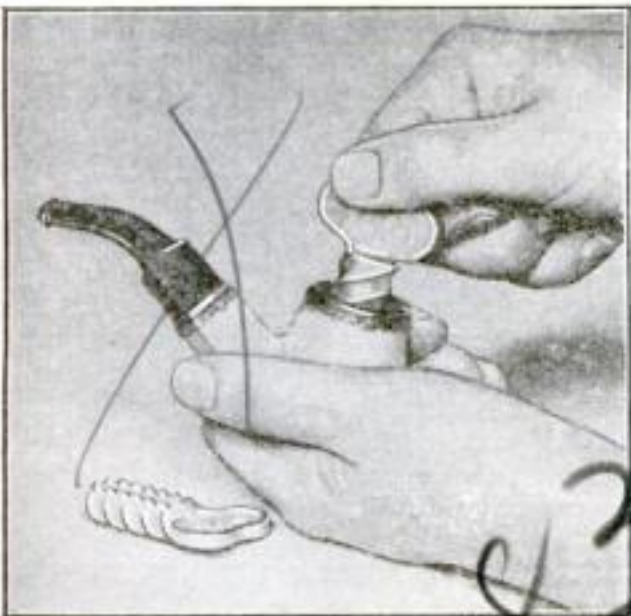


This Milk-Can Cover Is Operated by Pedal

AN INVENTIVE Indiana farmer has devised an effective apparatus to keep the milk in his can free from the dust and insects that invariably invade even the most sanitary dairy barns.

It consists of a broad cloth-covered lid of wood that rests on top of the strainer above the can while the milking is in progress. To pour his pail of milk into the can, the milker simply steps on a pedal, indicated by the arrow, which swings the lid upward and backward.

Handy Reamer Cuts "Cake" from the Old Pipe



DEVISED on the theory that the "cake" in pipes, contrary to the rooted conviction of thousands of smokers, taints rather than improves the taste of tobacco smoke, this augerlike cleaner cuts and bores out the charred accumulation. The reamer is inserted in the pipe bowl and slowly turned, scraping out the cake easily.

Most pipes are boiled in oil before they are finished, to prevent to some extent the formation of cake.

Iowa Boy Drives Midget Electric Auto

NEARLY every small boy has dreamed of owning a real automobile—one that really runs by itself. For the six-year-old son of Ralph Frick, of Burlington, Ia., this dream has come true. His father has built him a midget electric car that makes 12 miles an hour on the level, has automatic brakes, disk wheels, and a self-starter, and weighs 70 pounds.

At a state fair this play auto pulled a 2½-ton brougham several hundred feet in front of the racetrack grandstand. Yet, for all its power, and its detailed resemblance to full-sized models, the car embodies safety in a remarkable degree.

Electric power is generated from a four-cell battery under the hood, which runs the car 20 miles without need of recharging. Under the seat and connected with the rear axle is a self-starter. An electric spring shut-off accelerator adjusts the power and speed, and a reverse switch changes the direction of the current for backing. Automatic



This Iowa boy drives his own electric

brakes and an emergency brake are provided.

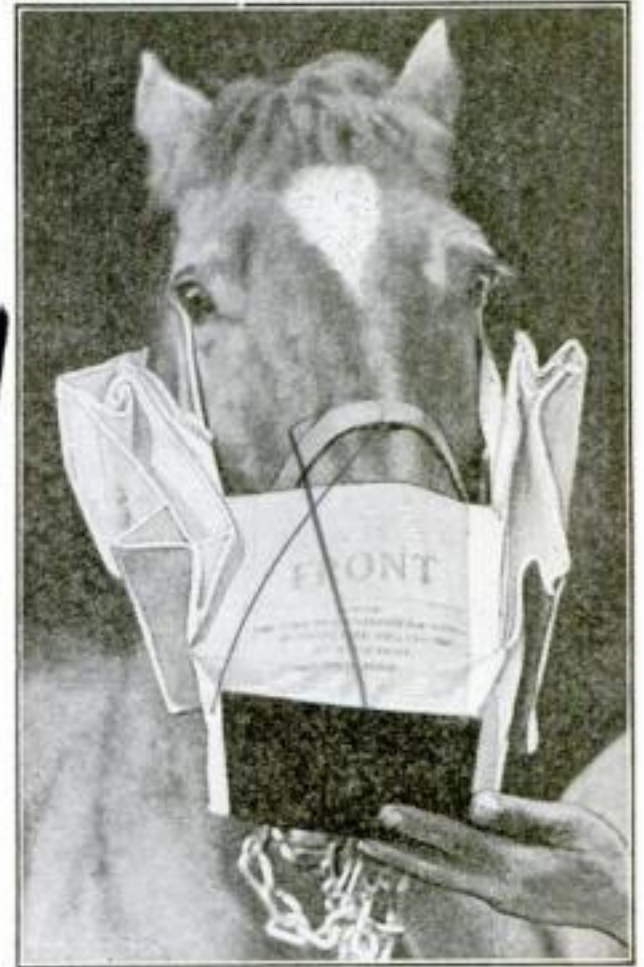
To start, the child places his foot on the self-starter button, transmitting power to the driving apparatus on the rear axle. When the foot is removed, the power instantly is shut off and the automatic brakes are applied. The back wheels immediately lock, so that even on a hill the car stops.

Disk Plow Designed to Break Hard Ground

A POSSIBLE solution of the plowing problem on hard ground is seen in the invention at San José, Calif., of a dust mulch pulverizer. The part of the machine that cuts into the ground consists of disks, set perpendicular and made of one-fourth-inch alloy steel. Breaker cutters from three-quarters to 1½ inches in width are attached to each of the disks.

The disks turn independently of the plow's speed, and revolve 250 times a minute. They cut into the ground from two to 12 inches, and are raised or lowered according to the depth of cut desired. The disks may be from 16 to 24 inches in diameter.

The pulverizer is driven by a 1½-



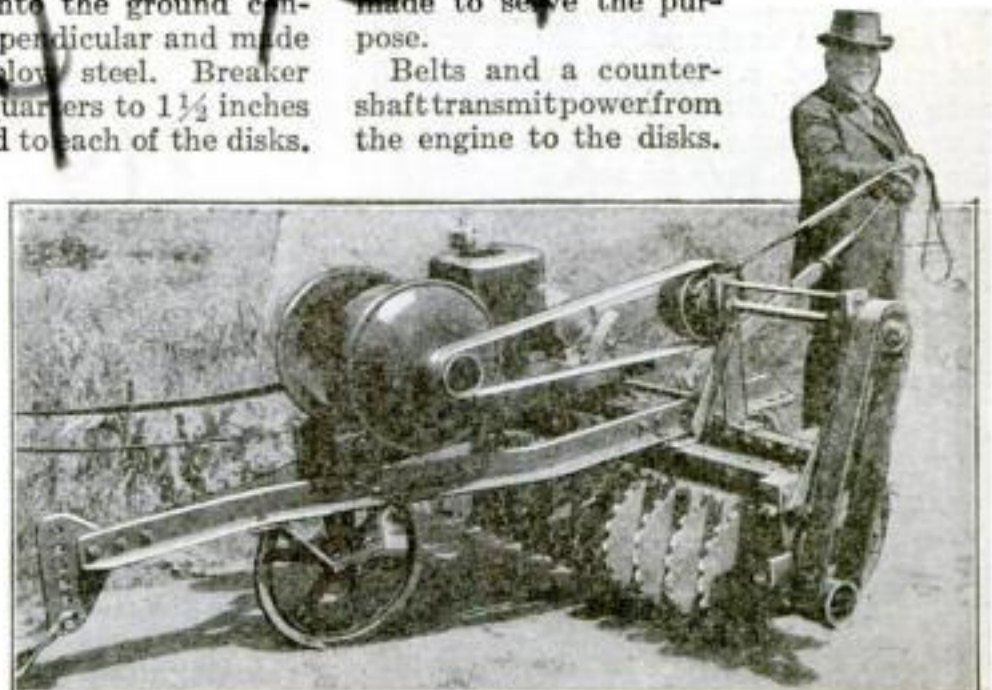
Horse Dines in Comfort from New Nose Bag

INVENTIVE ability and a love of horses combined to perfect this feed bag.

The old type of bag made simultaneous eating and breathing painful and sometimes barely possible for a horse. Moreover, in the struggle, the hungry animal often lost an exasperatingly large portion of his oats. The new bag has a reservoir on each side, from which the feed drops into the nose portion as this container is emptied. The roominess of the bag permits the entry of plenty of air for the horse to breathe.

The Women's League for Animals is responsible for the perfection of the bag and is urging its universal use.

GOVERNMENT hunters now use catnip to lure bobcats and mountain lions into traps.



Power-driven pulverizer, showing disks that cut into hard ground



© Keystone

Radio Watch Sets Itself by Time Signals

A RADIO watch apparatus that automatically sets the hands each noon when radio time signals are broadcast, has been invented by Lt. John Iseman, of the United States Navy, shown above.

The outfit consists of a miniature radio receiving set with a fixed wave length of 455 meters, a fixed cartridge detector, and a "self-restoring coherer" that closes the circuit between a small storage battery in the set and a sensitive relay ingeniously built into the watch.

The escapement wheel has as many teeth as the number of dots that are transmitted during the five-minute period in which time signals are broadcast. This wheel is rotated, one tooth for each signal sent, until the snap mechanism for setting the hands—as in a stopwatch—is released and the hands snap to noon.

A tiny aerial, 30 feet of gold-plated wire, is within the case of the set.

Crystal Set Is an Ashtray

A BUSY radio fan, whose desk was too crowded to give room for both an ash holder and a receiving set, conquered the problem by combining the two.

This little instrument has a crystal detector and a specially wound coil, atop of which rests the ash receiver. The set is connected with a light socket, the latter serving as an aerial.



Listening in with the ashtray receiver

New York Police Operate a Broadcasting Station

RIVALING the most powerful and elaborate broadcasting stations in the United States, New York City police headquarters station is a powerful ally of the law.

Broadcast descriptions of criminals and missing persons, it is believed, will place hundreds of thousands of persons on the alert as posters and handbills never could. Following fires, wrecks, or other severe disasters, the station will broadcast the names of all casualties, thus avoiding a flood of calls to the police from anxious friends and relatives.

When not in use for such purposes or serving in interdepartment communication, the station will broadcast concerts by the Police Department band, lectures bearing on matters of civic interest, and other programs.

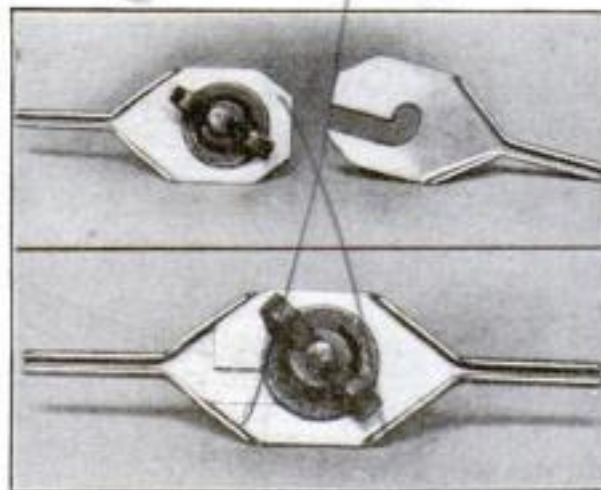


© U. & U.

Broadcasting station in police headquarters

Simple Clamp Takes Place of Lightning Switch

ALTHOUGH the only lightning safeguard required by the Board of Fire Underwriters is an arrester connected across the lead-in and ground wires of a



The wingnut makes a strong connection

radio outfit, many radio owners choose to take the extra precaution of connecting in a lightning switch so that they may be certain of a positive connection between the aerial and the ground.

A simply constructed clamp that meets this need while obviating the standard lightning switch, is shown in the illustration above. Connection is made by slipping the slotted member into the projecting screw of the other member and tightening down with the wingnut. The bayonet joint makes a strong connection.



Eiffel Tower Model Holds Powerful Receiver

THIS model of the famous Eiffel Tower of Paris serves as a novel and decorative radio set of the three-circuit regenerative type. The receiver has two stages of audio amplification, permitting the use of a loudspeaking horn.

Lubricating Switchpoints

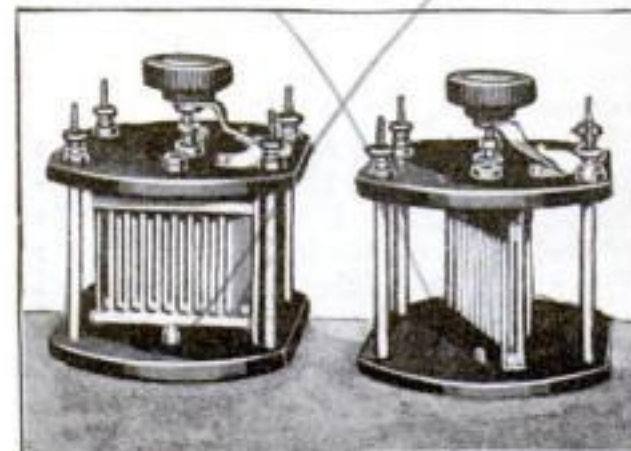
A LITTLE vaseline rubbed lightly on the switchpoints of the radio receiver will make the arm slide easily over the points and obviate any chance of friction wearing down the points.

New Variable Condenser

THE latest wrinkle in variable condenser construction comes from France. Every radio fan is familiar with the standard type of variable condenser in which the change of capacity is accomplished by varying the amount of surface presented to one set of plates by another.

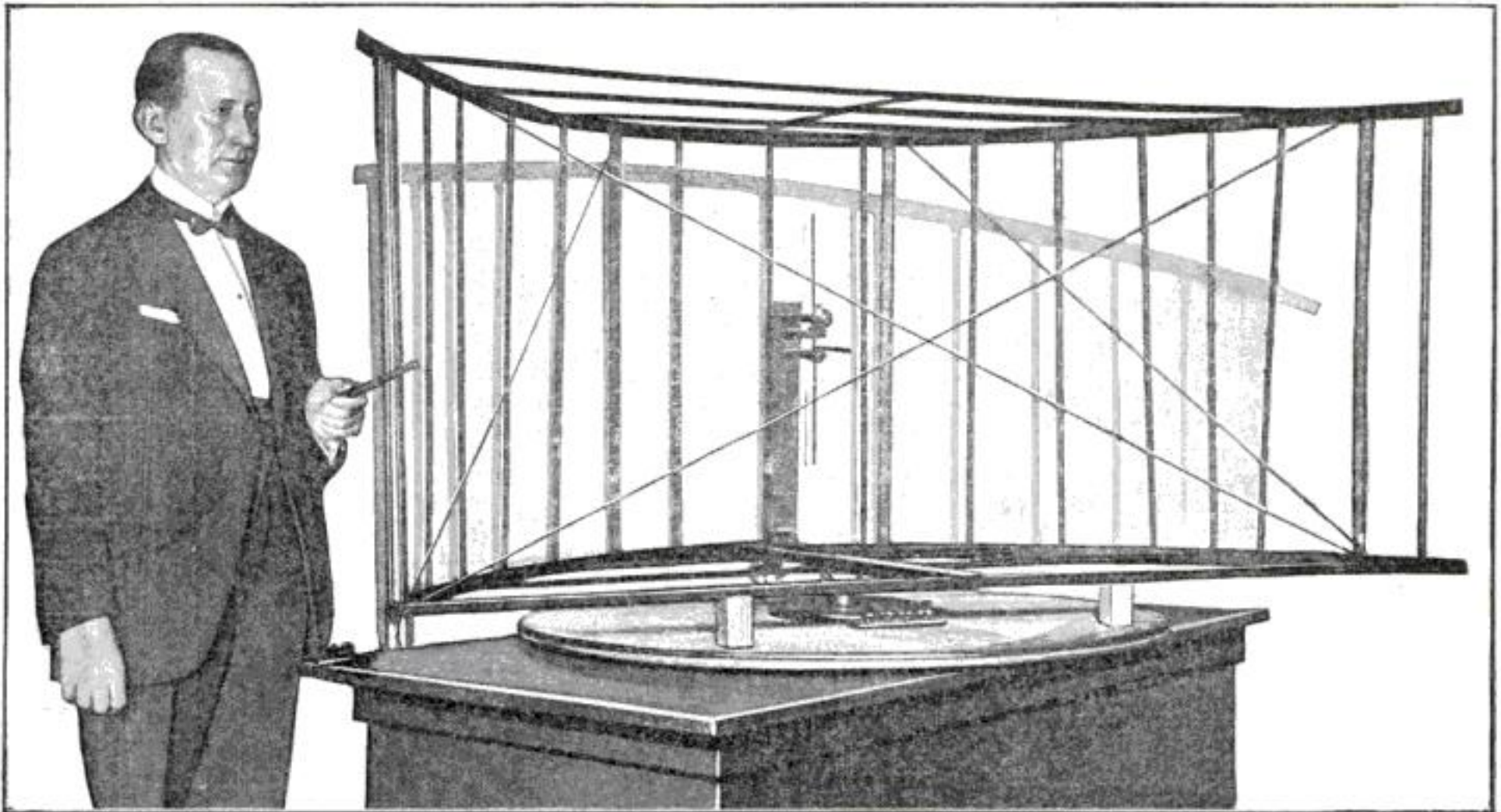
In the new type of condenser the principle that the capacity of a condenser can be changed by varying the distances between two sets of plates is utilized.

Rectangular plates are so mounted between four horizontal supports that when the central knob, connected with these supports by a linkage system, is turned, the distances between the two sets of plates is varied, thereby changing the capacity of the instrument.



Turning knob varies distance between plates

Secrecy in Directed Radio



Senator Guglielmo Marconi, discoverer of wireless transmission, and his "radio searchlight," an antenna reflector with which he has succeeded in throwing a powerful beam of radio waves in any given direction, in the same manner that a mirror reflects a beam of light

By Jack Binns

America's Most Popular Writer
on Radio

A FEW weeks ago Signor Marconi announced that radiotelephone communication had been established between England and the Canary Islands—over a distance of about 2000 miles. While on the face of it there was nothing extraordinary in this statement, it encompassed an achievement of tremendous importance in world communication; for the long-distance messages were directed to a specified point under conditions that practically insured secrecy from all radio receivers except the one for which the messages were intended.

The "Radio Searchlight"

The success of this long-distance test was the result of Marconi's continued experiments with the "radio searchlight," by means of which he focuses radio waves in a powerful beam in a definite direction. Direction of the waves is accomplished by means of an antenna reflector that throws a beam of radio waves in much the same manner that a hand mirror throws a beam of light waves.

In conjunction with other experiments along similar lines, Marconi's announcement would seem to indicate that commercially practical application of secret radio is not far distant.

Recent experiments to achieve complete secrecy have followed three distinct lines, as follows:

1. Reflected waves of tremendously high frequency, directed as a radio beam toward a specified point.

2. Obtaining secrecy by means of suppressing the carrier wave and one of the side bands.

3. Deliberate "scrambling" of speech in transmission so that only a receiver especially designed to translate it can understand the message.

The first type of experiment is being followed by Marconi and British experimenters associated with him, while the second and third types are being pursued by American experimenters. By a strange coincidence, the first two offer the advantage of requiring less power than is normally necessary to cover a specified distance.

The success of Signor Marconi's reflection method depends upon a principle made practical by the development of the vacuum tube and the super-heterodyne receiver. There is a certain romance about this system, for it was the very first employed by Marconi in the late '90's when he startled the world by communicating between two points without the aid of connecting wires.

Almost Missed Broadcasting Marvels

Experiments previous to his own had determined the fact that reflection of electromagnetic waves was just as feasible as the reflection of light waves. With this in mind, Marconi set about to develop such reflectors, employing them at the transmitting and receiving ends of his apparatus. By doing so, he almost missed the wonderful possibilities that radio opened by its very ability to broadcast in every direction, without which communication between ships would have been utterly impossible. But the crude appa-

ratus in use in those early days precluded the development of reflected waves. As a result, Marconi turned his energy to perfect and extend ship communication.

Shortly before the war, however, Marconi again reverted to his first love, investigating its possibilities upon extremely short waves where the frequencies involved run above the 100,000,000 a second mark. At first he used spark transmitters, and achieved some slight success, but real results did not materialize until the oscillating vacuum-tube circuit was discovered.

Great Progress in Radio Reflection

Tremendous strides in the reflected-wave system of communication in the past two years have been made possible by the regenerative circuit and the super-heterodyne principle. The former is used in transmission and the latter in reception. The system of reflection, however, is Marconi's own, developed by him and his assistants, chief of whom is C. S. Franklin, a prominent British radio engineer.

Secrecy in reflected waves lies in the fact that the waves, instead of being broadcast in every direction, are concentrated in a single beam by suitable reflectors, then shot forward in a direct line between the transmitter and the receiving apparatus. Naturally such a beam is governed by the laws that govern reflected light beams—the farther it travels from the producing source, the more the beam broadens.

Only a receiver that is in the path of this reflected beam can intercept the message it carries. Even then, the

receiver must be especially designed to respond to such terrific frequencies.

Marconi's recent successes over vast distances with this system have been achieved by painstaking development of the antenna system used with the receiving apparatus. He found that if at the receiving end he used a radio mirror that was a replica of the one employed at the transmitting station, signal strength was increased materially and greater distances could be obtained.

Perhaps there is an analogy between the radio reflector and the gigantic reflector mirrors used in large astronomical observatories to pick up and concentrate the weak light-wave energy received from distant stars, which could not be seen by the unaided human eye. The ordinary radio receiver in this case could be likened to the unaided eye, while Marconi's receiving apparatus would correspond to the giant reflectors.

A Second Method for Secrecy

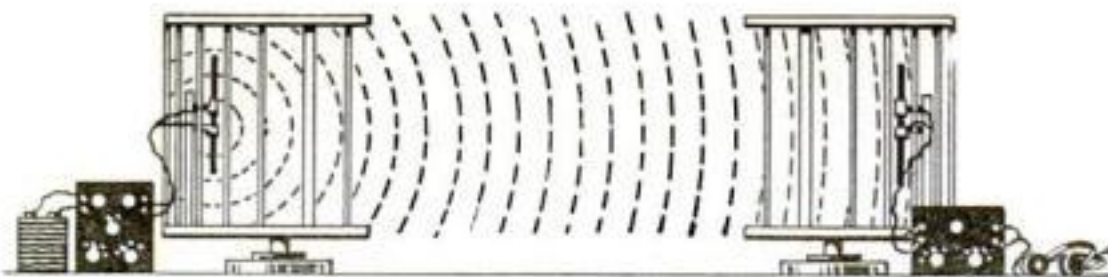
In my opinion, the second system I have mentioned—that of obtaining secrecy by suppressing the carrier wave and one of the side bands—offers even greater possibilities with fewer drawbacks. Reception in this case can be obtained only with a receiver equipped to provide the missing frequency of the suppressed carrier wave by means of a local oscillator.

In addition, the system requires what might be termed less space in the ether, thereby making available a larger number of channels for communication. This is a particularly valuable consideration for commercial transatlantic communication. In such transmission only long waves are available; and since the frequency difference between any two sets of long waves is very small, the number of channels available is very small.

As an illustration, suppose we take a 5000-meter wave (the one that has been used in the actual experiments). Such a wave has a frequency of 60,000 cycles a second. A wave of 6000 meters has a frequency of 50,000 cycles a second. Thus, while there is a difference of 1000 meters between these two waves, the frequency difference is only 10,000 cycles. This means that if both of the carrier waves and their side bands were radiated at the same time, the lower side band of one wave would interfere with the upper side band of the other.

Prevents Interference

The system of suppressing the carrier wave and one side band would prevent such interference. In addition, there is the added advantage of secrecy obtained by the absence of the carrier and one of the side bands. Of course, absolute secrecy has not yet been attained by this method. It is possible to receive such signals on any oscillating regenerative



This diagram illustrates Marconi's system of directed radio. Instead of being broadcast in all directions, radio waves are concentrated by an antenna reflector (at the left) into a radio beam which is directed toward receiving antennae

receiver, yet the speech so received is more or less distorted, assuring a certain measure of secrecy.

While experiments with the system have been restricted to transoceanic communication on fairly long waves, there is no reason why they should not be applied to telephone communication across land spaces with small power and on short waves, along the lines that govern amateur radiotelephone transmission. The transatlantic experiments have been con-

ARE you getting the most out of your radio receiver? Or is there some elusive imperfection that limits the range of your radio pleasure? Next month Jack Bins will reveal secrets of selecting and operating apparatus and circuits that will help you bring your set up to maximum efficiency.

ducted from the huge radio transmitting station at Rocky Point, L. I., where high-powered water-cooled vacuum-tube amplifiers are employed.

The transmitting apparatus consists of two modulators, two filters (which eliminate the carrier and one side band), and three amplifiers. After the filtration has been completed, the output is passed through the first amplifier with a power rating of 750 watts, then through the second, which has a power of 15 kilowatts, and finally through an amplifier

with a power of 150 kilowatts, which has been found sufficient to transmit signals across the Atlantic in daylight. An idea of the tremendous amount of this power can be obtained by considering that in the average first-class radio broadcasting station, only one half of a kilowatt is employed for radiation purposes.

In transatlantic tests during the past year, interesting data was obtained. From experience with transatlantic radiotelegraph work, it was expected that daylight reception would be more difficult than the night transmissions. This was verified by actual experience.

Tests were made every hour of the day for a period of 12 months, and a careful record made of the signal strength, as compared with the strength of interfering noises such as static. The results obtained were then plotted on curves, so that it was possible to get a clear idea of conditions.

New Facts about Reception

It was found generally that reception in the winter months in England was best just before daybreak. Strangely enough, it was found that in the summer months the best reception occurred a few hours after daybreak in England.

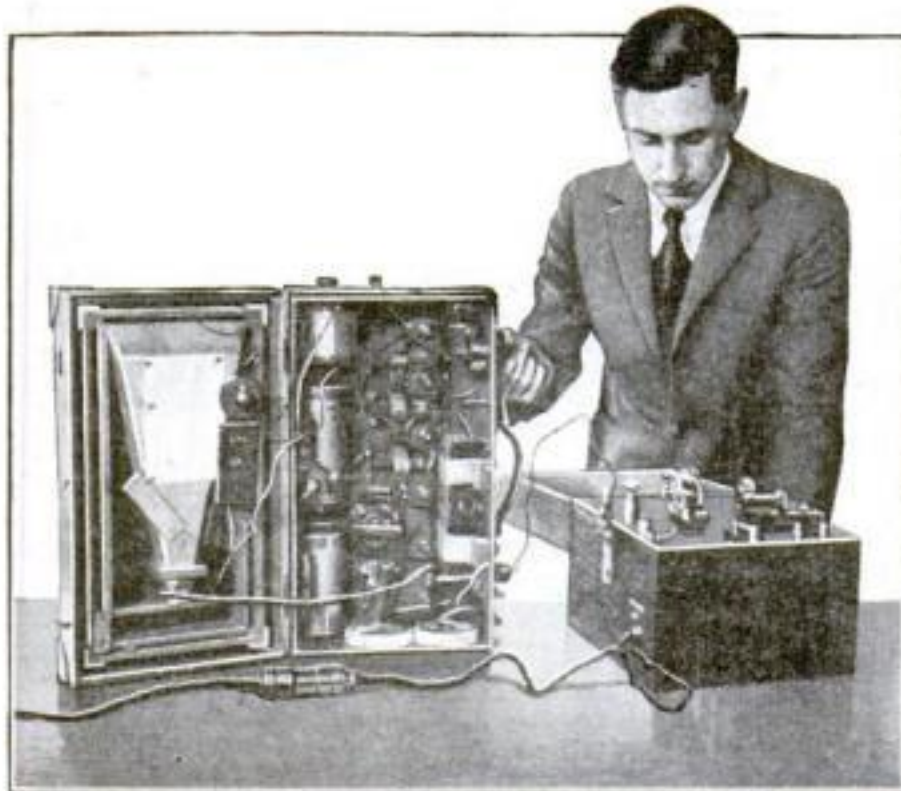
One of the interesting points brought out by the experiments is the fact that reception is neither very good nor very bad during the three hours when business is in full swing both in London and New York City. This occurs between the hours of nine o'clock in the morning and noon, New York time.

Reception is accomplished with a specially designed super-heterodyne receiver with which a local oscillator is connected for the purpose of supplying the frequency corresponding to that of the missing carrier wave. The key to the whole system is the missing frequency that must be produced locally in order to obtain satisfactory and undistorted reception.

"Scrambling" Messages

The third system mentioned at the beginning of this article is that of "scrambling" the message that is being transmitted. It is based on the idea of deliberately distorting speech in the modulating system before the voice currents are impressed on the transmitter. A receiving set designed to pick up the messages would respond to the distorted vocal frequencies, make the necessary allowances and reproduce perfectly understandable words.

Should this system prove successful eventually, it could be applied readily to either of the other two systems described. In fact, there is no reason why all three systems should not be merged—when they have completely passed out of the experimental stage—into one absolutely accurate system of secret communication.

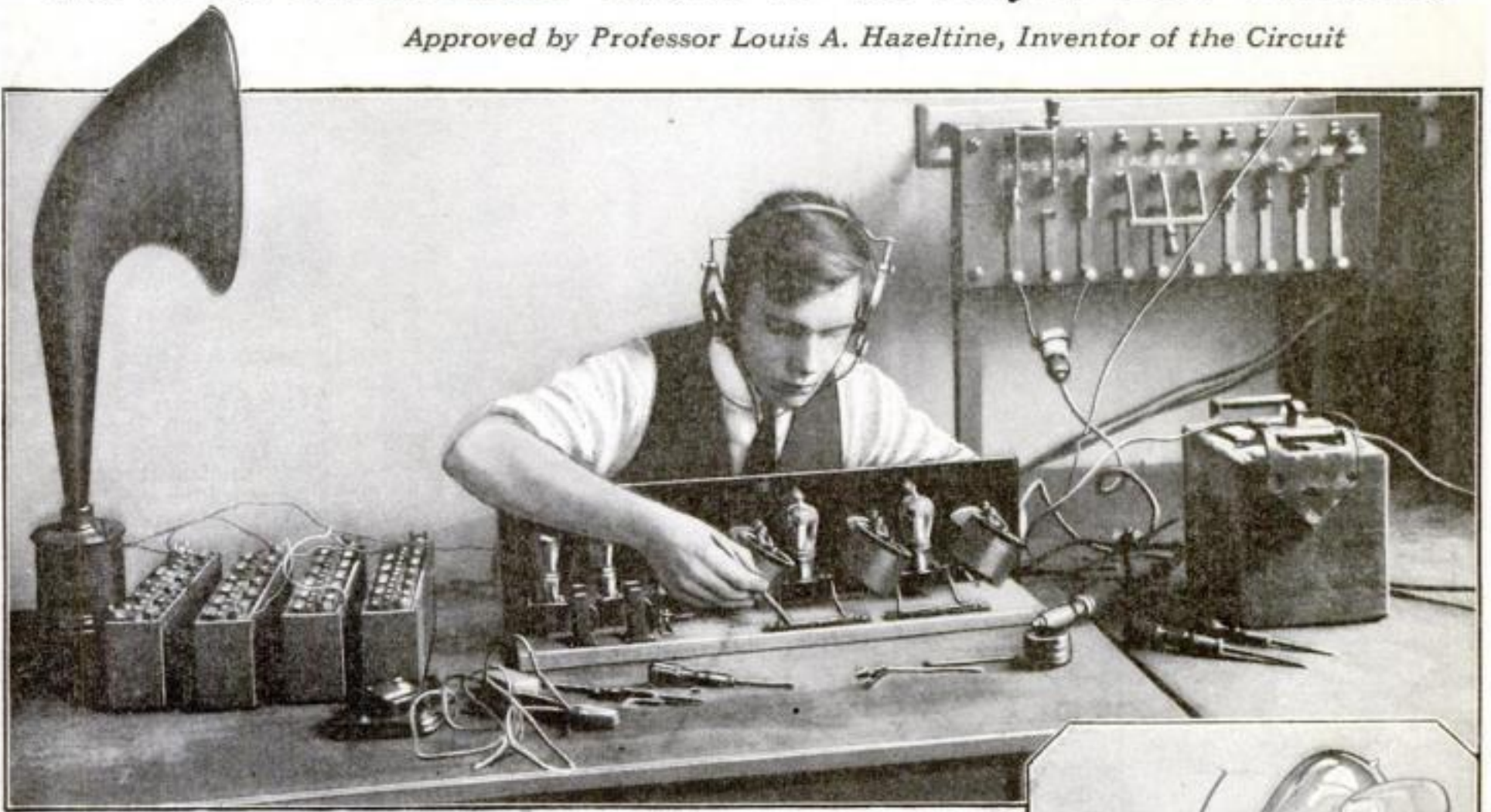


One of the most noteworthy of recent contributions to the development of radio communication is an instrument that is said actually to record spoken words received by wireless. It is the invention of Francis Dunmore, of Washington, D. C., who is shown above with his creation, known as a radio relay recorder. He claims it makes possible the distant control of any mechanism by radio

How to Build a Neutrodyne Set

The Most Authoritative Article on the Subject Ever Published

Approved by Professor Louis A. Hazeltine, Inventor of the Circuit



By J. F. Dreyer, Jr.
Engineer of the Hazeltine
Research Corporation

J. F. Dreyer, Jr., at work in the electrical laboratory of the Stevens Institute of Technology, Hoboken, N. J., adjusting the neutralizing condenser of the standard five-tube neutrodyne receiver described by him clearly and interestingly in the accompanying article



Fig. 3. A piece of paper over one prong of the tube aids in the adjustment

THE chief advantages of Professor Hazeltine's neutrodyne receiver are great amplification of weak signals;

a high degree of selectivity; freedom from objectionable squeals and noises; faithful reproduction of broadcast programs; absence of re-radiation (an effect that disturbs neighboring receivers and that is present in most other receivers); and, finally, the unique feature that the several tuning controls are independent of one another and of the filament rheostat settings. This makes it possible to repeat the identical dial settings night after night for any particular station.

The purpose of this article is to describe, for the radio enthusiast who prefers to build his own set, how to construct a standard five-tube neutrodyne receiver, using the standard units. The parts required are as follows (see Fig. 1):

- Set of neutrodyne parts, consisting of 3 radio-frequency transformers, with variable air condensers, A, B, and C, and 2 neutralizing condensers, J and K
- 1 panel, bakelite or hard rubber, about 26 by 7 by 3/16 in.
- 1 baseboard, about 25 by 6 by 3/8 in.
- 5 vacuum-tube sockets, D, E, F, G, and H (the kind that mount directly on the panel are convenient)
- 2 audio-frequency transformers L and M
- 3 4-inch dials
- 1 6-ohm rheostat, Q
- 1 30-ohm rheostat, P
- 7 binding-posts
- 1 single-circuit jack, O, and 1 double-circuit jack, N (see wiring diagram, Fig. 2)
- 1 fixed condenser, 0.001 mfd., T

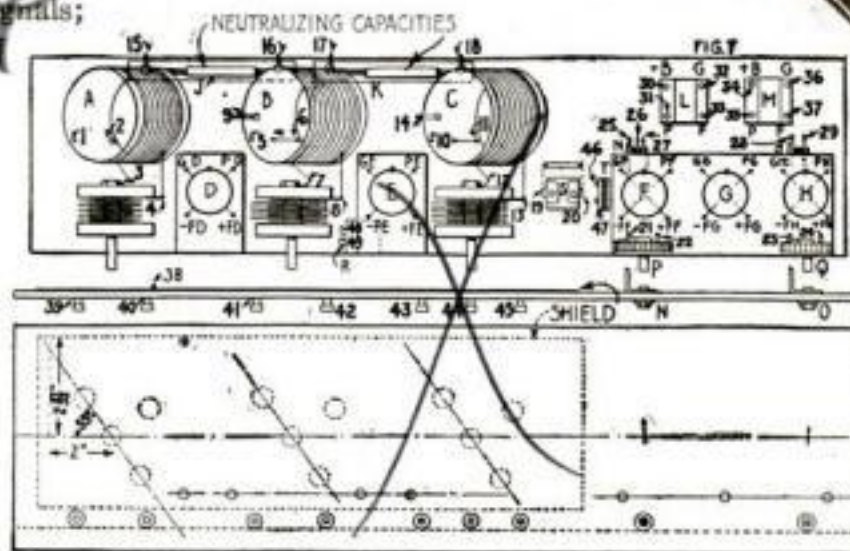


Fig. 1. Diagrammatic layout of the neutrodyne receiver showing position of parts

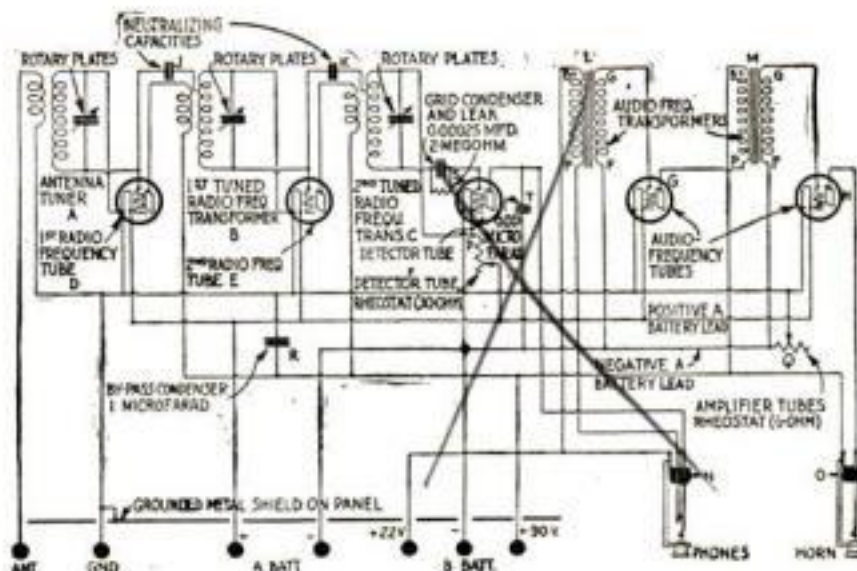


Fig. 2. Complete wiring diagram as approved by Professor Hazeltine

- 1 fixed condenser, 0.00025 mfd., with clips for grid leak, S
- 1 fixed condenser, 0.1 mfd. or more, R
- 1 grid-leak resistance, 2 megohms
- 1 piece of sheet copper for shield, 20 by 5 by 0.010 in. approximately (almost any other kind of sheet metal will do if this is not easily obtainable)
- Copper wire for connections
- Varnished cambric insulating tubing

The neutrodyne receiver is not the easiest type for the home worker to build. This fact will, however, probably make the enthusiastic worker more anxious to try his hand at it.

The arrangement and spacings of the various parts are extremely important, so much so that any divergence from the one suggested is likely to give great trouble to the experimenter.

Figure 1 gives the panel layout and a top view of the receiver. The different parts referred to in the list of materials are lettered, and the points where electrical connections are made are numbered or lettered. A good way to proceed in the assembly is as follows:

Mark off the panel on the back with a scribe, and drill clearance holes for the shafts of the three

(Continued on page 146)

New Tools and Machines Designed



This ingenious four-deck lid is designed to fit pots and pans of practically any diameter within the limits of the largest and smallest flanges of the lid. The four diameters shown above were selected after tests with hundreds of different containers



Stove, pantry, ice chest, and kitchen cabinet all are combined in one compact unit in a new type of kitchenette for the small apartment. Every necessity for a meal is within reach



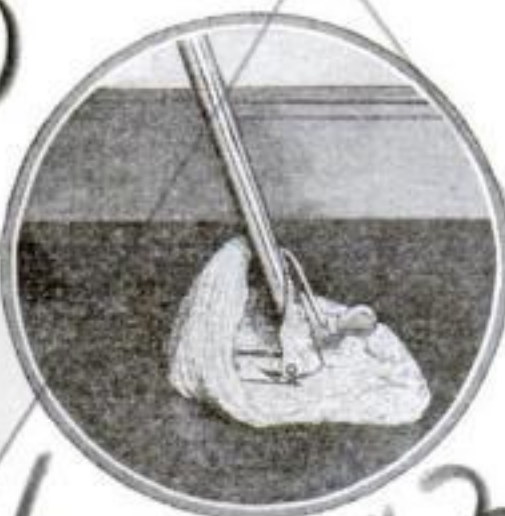
Through holes in the trough of this squeezer, lemon or orange juice drips as fast as it is squeezed from the fruit into the pitcher on which the device rests. The holes are said to prevent the usual wasteful spilling of juice when poured from the ordinary squeezer



This aluminum mold is designed to turn out individual cakes with shallow circular wells indented in the top. Into these wells may be placed ice cream or fresh fruit, as shown



Hinged at the center, this novel coat hanger is folded, when not in use, to form a clothes brush with two rows of bristles. When used as a brush, the wire hook is removed



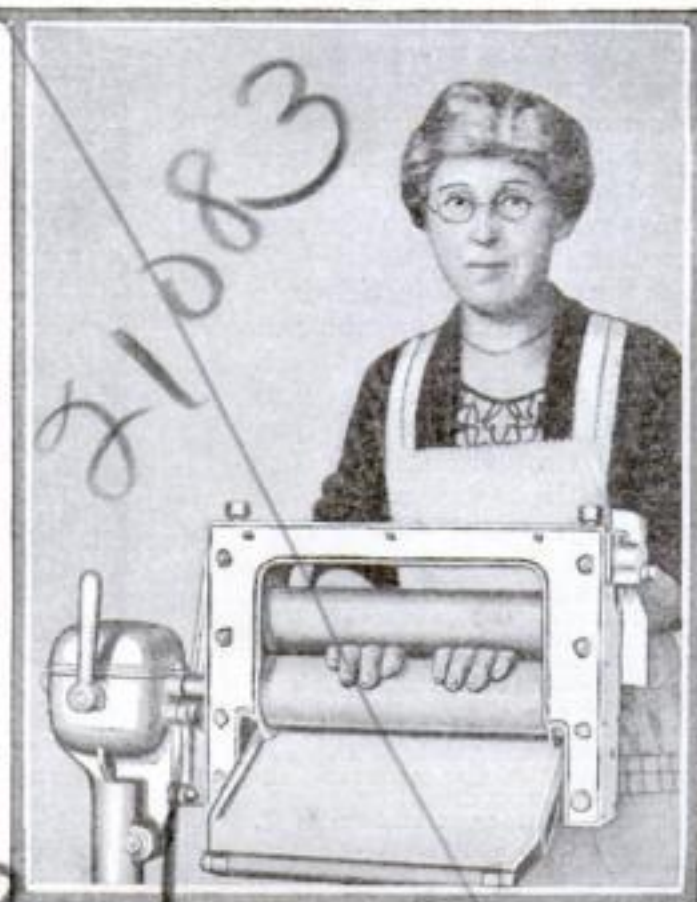
To take the drudgery out of scrubbing day, and to save the housewife's hands, this mop is equipped with a wringing crank. Three turns of the crank are said to squeeze out the water



Apartment dwellers will appreciate a new disappearing cedar chest that rolls under the bed on tracks, making use of valuable space that otherwise would be wasted



Juices from the meat as it is cooked on the top section of this aluminum broiler are caught in grooves and conveyed to a deep outer depression in the lower griddle



Equipped with extra large, pliable rubber rollers, a new electric wringer cannot injure the fingers nor break buttons, it is claimed. The frame is made of aluminum

for the Housewife's Workrooms



Any cylindrical cooking vessel can be transformed into an electric cooker, it is claimed, when it is encircled by this electric heating band. The band containing heating units is adjustable to fit pots of various sizes.



This electric fireless cooker is attached to a light socket and may be regulated to start and stop at any specified time in the housewife's absence. The top is reversible, providing an electric grill for frying, broiling, and toasting. Two heating units direct the heat upon the cooking food from both top and bottom.



Poached eggs are molded to shape by this utensil. The eggs are placed in aluminum rings that rest on a flat base. A lever raises the rings.



The medicine bottle can be kept free from dust by means of this rubber hood that fits over the top of the cork and eliminates germs.



An ordinary plate is converted into a sandwich tray by attaching this handle to the plate rim. Springing the ends apart removes the handle.



Photo - R. A. Hunt
The task of removing the layers of a baked cake from their pans without breaking them has been simplified by a pan made in two units, as shown above. By removing a metal clamp, the wall of the pan can be separated and lifted easily from the bottom.



Photo - Fleet Agency
Here is an electrical household servant that quickly cleans, dries, and polishes glasses. A center buff polishes the inside of the glass, while four outer buffs give the outside a good polish.



An opened cream bottle hung in this holder is protected from dogs, cats, rain, or snow. The neck slides into slots at the sides.



Wringer and washboard are combined in this handy new aid for washday. Springs controlling the grip of the rollers are said to permit wringing material that is half an inch thick.

Your Home Garden— How to Make It Pay

An Expert Tells the Secrets of Scientific Vegetable Planting and Cultivation

By Ernest Bade, Ph.D.

PROBABLY no hobby has more adherents than gardening. Few persons who have a plot of ground available fail to cultivate it, for there is a strange thrill in watching the seeds you have planted grow to maturity, and much pleasurable, healthful exercise to be derived from working the soil. There is an immense amount of satisfaction, too, in producing good crops and supplying fresh vegetables for your table. It is a satisfaction that any amateur gardener can experience if he will use care in selecting his seeds and will follow a few simple principles in cultivating his land.

How to Start Right

If the land you intend to use for your garden has not been under cultivation before, you cannot grow vegetables successfully there until you have destroyed the acid in the soil by sprinkling the ground lightly with lime. This also loosens the earth, permitting you to work it more easily.

Spade up the ground thoroughly, working the lime into the soil. Then add stable manure for fertilizer, mixing this in thoroughly. Be sure that the manure is well-rotted, since fresh manure is useless for fertilizing. Also, do not use such commercial fertilizers as are especially prepared for the peculiar needs of the professional farmer, for they are not suited to the home garden. Stones, of course, should be removed while the bed is being worked. When the ground has been smoothed off with a rake, it is ready for planting. If the land has not been idle for any length of time, the use of lime is not necessary in the preparation of the bed.

Remember that most vegetable plants have their origin in warm countries. Consequently they are not hardy, and they cannot withstand extreme climatic changes. The garden, then, should be located, if possible, in a warm, protected place—one that admits both light and air. Land with a southern exposure makes the ideal location for a garden. Protection for the plants from the wind and

cold usually can be obtained by screening the garden with high plants or with fences to break the force of the wind.

Since most amateur gardeners have no large plot at their disposal, intensive cultivation becomes a necessity. All



In planting seeds, a line of stout cord will help keep the rows straight

A Time-Table for Planting Vegetables

STATES AND SECTIONS	SOW OR PLANT OUT		KILLING FROSTS	
	Hardy Vegetables	Tender Vegetables	Spring Average Last	Autumn Average First
Alabama.....	Feb. and Mar.....	Mar. and Apr.....	Feb. 24 to Mar. 11	Nov. 8 to 30
Arizona.....	Jan. and Feb.....	Mar. and Apr.....	Feb. 18 to Feb. 23	Dec. 7
Arkansas.....	Mar. and Apr.....	Apr. and May.....	Mar. 1 to 20.....	Nov. 5 to 10
Calif., Mid. Sou.....	Feb. to Apr.....	Mar. to Apr.....	Mar. 10 to Mar. 17	Dec. 17
Calif., Northern.....	Mar. and Apr.....	Apr. and May.....	Apr. 2 to 16.....	Nov. 15 to 25
Colorado.....	Apr. and May.....	Late May and June.....	Apr. 11 to May 15	Oct. 7 to 29
Connecticut.....	Mid. Apr. and May.....	Late May.....	Apr. 15 to May 1	Oct. 17
Delaware.....	Apr. and May.....	Mid May.....	Apr. 10 to 20.....	Nov. 1
Florida, South.....	Jan. to Feb.....	Late Feb. and Mar.....	Feb. 8 to 14.....	Dec. 29
Florida, North.....	Feb. and Mar.....	Late Mar. and Apr.....	Feb. 19 to 23.....	Dec. 5
Georgia.....	Feb. and Mar.....	Late Mar. and Apr.....	Mar. 1 to 24.....	Nov. 7 to 26
Illinois.....	Apr. and early May.....	Mid May to June.....	Mar. 29 to Apr. 20	Oct. 15 to 28
Indiana.....	Apr. and early May.....	Mid May to June.....	Apr. 10 to 16.....	Oct. 19 to 30
Iowa.....	Apr. and early May.....	Late May.....	Apr. 10 to May 1	Sept. 23 to Oct. 17
Kansas.....	Late Mar. and Apr.....	Mid May.....	Apr. 6 to 24.....	Oct. 14 to 19
Kentucky.....	Late Mar. and Apr.....	May.....	Apr. 6 to 18.....	Oct. 19 to 29
Louisiana.....	Feb. and Mar.....	Late Mar. and Apr.....	Jan. 24 to Mar. 4.....	Nov. 11 to Dec. 15
Maine.....	Early May.....	Late May and June.....	May 14 to 28.....	Oct. 12 to 18
Maryland.....	Mar. and Apr.....	Late Apr. and May.....	Apr. 4 to 18.....	Nov. 4
Massachusetts.....	Late Apr. and May.....	Mid May to June.....	Apr. 10 to 26.....	Oct. 22 to Nov. 5
Mich., South.....	Mid Apr. and May.....	Mid May to June.....	Apr. 30 to May 8.....	Oct. 10
Mich., North.....	May.....	Late May and June.....	May 10 to 16.....	Sept. 24 to Oct. 2
Minnesota.....	May.....	Late May and June.....	May 6 to 14.....	Sept. 22 to Oct. 14
Mississippi.....	Feb. and Mar.....	Late Mar. and Apr.....	Mar. 1 to 20.....	Nov. 2 to 12
Missouri.....	Late Mar. and Apr.....	Late Apr. and May.....	Apr. 2 to 16.....	Oct. 13 to 27
Montana.....	Mid May.....	June.....	May 10 to 12.....	Sept. 18 to 25
Nebraska.....	Apr. and May.....	Late May.....	Apr. 15 to May 9.....	Sept. 18 to Oct. 12
Nevada.....	May.....	June.....	May 11 to 29.....	Sept. 24
New Hampshire.....	May.....	Late May and June.....	May 13 to 20.....	Sept. 16
New Jersey.....	Apr. and early May.....	Mid May and June.....	Apr. 11 to 16.....	Nov. 4
New Mexico.....	Mar. and Apr.....	Late Apr. and May.....	Apr. 15.....	Oct. 19
New York, South.....	Apr. and early May.....	Mid May and June.....	Apr. 10 to 24.....	Nov. 6
New York, North.....	May.....	Late May and June.....	Apr. 25 to May 1.....	Oct. 6 to 19
North Carolina.....	Mar. and Apr.....	Late Apr. and May.....	Feb. 28 to Apr. 5.....	Nov. 4 to Dec. 11
North Dakota.....	May.....	Late May and June.....	May 15 to 18.....	Sept. 15
Ohio.....	Mid Apr. and May.....	Mid May and June.....	Apr. 14 to 24.....	Oct. 15 to 31
Oklahoma.....	Mar. and Apr.....	Mid Apr.....	Apr. 2.....	Oct. 31
Oregon, West.....	Mar. and Apr.....	Late Apr. and May.....	Apr. 15 to 20.....	Oct. 30
Oregon, East.....	May.....	Late May and June.....	June 3.....	Sept. 27
Pennsylvania.....	Apr. and May.....	Mid May and June.....	Apr. 8 to 26.....	Oct. 19
Rhode Island.....	Mid Apr. and May.....	Late May and June.....	Apr. 18 to May 1.....	Oct. 16 to Nov. 16
South Carolina.....	Feb. and Mar.....	Apr. and early May.....	Mar. 1 to 23.....	Nov. 8 to 30
South Dakota.....	Late Apr. and May.....	Late May.....	Apr. 30 to May 1.....	Sept. 20 to 30
Tennessee.....	Mar. and Apr.....	May.....	Mar. 24 to Apr. 3.....	Oct. 24 to 28
Texas, South.....	Feb. and Mar.....	Mar. and Apr.....	Feb. 5 to 27.....	Nov. 30 to Dec. 25
Texas, North.....	Mar. and Apr.....	Apr. and May.....	Mar. 20 to Apr. 16.....	Nov. 1 to 19
Utah.....	Apr. and May.....	Late May and June.....	Apr. 23.....	Oct. 18
Vermont.....	May.....	Late May and June.....	May 13 to 18.....	Sept. 16
Virginia.....	Mar. and Apr.....	Late Apr. and May.....	Mar. 27 to Apr. 23.....	Nov. 1 to 22
Washington.....	Mar. and Apr.....	May.....	Mar. 14 to Apr. 6.....	Oct. 17 to Dec. 15
West Virginia.....	Apr. and May.....	Late May.....	Apr. 11 to May 12.....	Oct. 4 to 17
Wisconsin.....	Apr. and May.....	Late May and June.....	Apr. 21 to May 5.....	Oct. 4 to 17
Wyoming.....	May.....	June.....	May 19 to 22.....	Sept. 11 to 16



Photo and table
courtesy Peter
Henderson & Co.

THE HARDY VEGETABLES, referred to above, the seeds of which may be sown, or the plants set out very early, even before the last of the frosts are over, are:

Asparagus, Beet, Broccoli, Brussels Sprouts, Cabbage, Carrot, Cauliflower, Celeriac, Celery, Corn Salad, Cress, Endive, Kale, Kohl Rabi, Leek, Lettuce, Onion, Parsley, Parsnip, Peas, Potatoes, Radish, Rhubarb, Salsify, Spinach, Turnip, and Witloof.

THE TENDER VEGETABLES, the seeds of which should not be sown in the open, nor the plants set out until both weather and ground are settled and warm, are:

Beans, Corn, Cucumber, Egg Plant, Melon, Okra, Pepper, Pumpkin, Squash, Sweet Potato, and Tomato.

If you are setting out a backyard vegetable garden this spring, cut out this table and tack it up where you can use it for handy reference.

available land must be under cultivation continuously during the gardening season if a maximum yield of crops is expected. This effect usually is obtained in a small garden by sowing the seeds of plants that do not come to maturity until the fall in beds that already have yielded a crop of early vegetables.

Intensive Planting

It is quite feasible to sow early and late vegetables together in the same bed. The early vegetables develop so rapidly that they can be harvested before the late vegetables have begun to develop.

The rotation of crops, so necessary in large farming operations, is even more important in the small garden. That is, the same beds must not be planted for the same crops year after year. Different plants absorb different elements from the soil in the process of growth, and it is virtually impossible to replace these elements by fertilizing. You cannot increase the yield of your garden by planting thickly. A given area of ground can produce plants only up to a certain limit, and crowding the plants will cause them to die.

Owing to climatic differences in various sections of a country as large as the United States, it is impossible to lay down any hard and fast rule as to the proper time for starting your garden. You should wait, of course, until you are certain that the frost is out of the ground, and you should delay planting until the soil is well prepared. Sowing the seeds a few days late is preferable to losing your crop because the seeds have been placed in poorly prepared soil. A sandy soil, which heats more quickly, permitting heat to reach the roots more readily, can be sowed earlier than a clay soil.

Begin planning your garden early in the year, deciding definitely on the location of the various plants and drawing a diagram of the land you intend to cultivate. This will avoid loss of valuable time when you are ready to sow.

An Early Start with Hotbeds

Hard seeds will germinate more quickly if they are soaked in warm water—about 120° F.—for about 12 hours before planting. The planting, however, should follow immediately the soaking of the seeds.

A hotbed for the cultivation of seedlings will enable you to start certain vegetables as early as February or March. If you can obtain a few old windows, you can make an excellent hotbed by constructing box frames of 12-inch lumber, using the windows as glass covers. These should face the south or southwest, with one

The Right Way to Grow Seedlings



Place flat stones in the seed box for good drainage



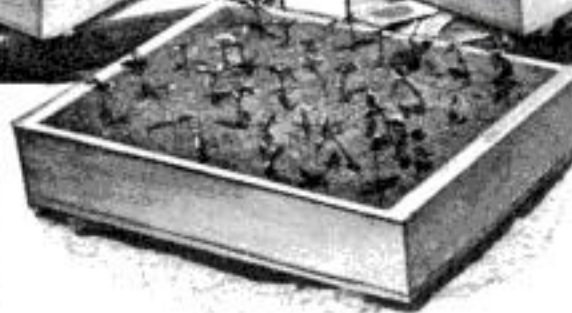
Fill the box with layers of manure and rich soil



Plant the seeds in shallow rills running in parallel lines across the box



After the seeds are planted, fill the rills with soil, covering the seeds



A box of vegetable seedlings ready to be transplanted in the garden

end raised so that the box slants toward the sun at an angle of about 30 degrees. Fill the box to the depth of about a foot with decomposing manure. Moisten, pack down and cover with four or five inches of good soil. Insert a thermometer about two inches in the soil, and, when the temperature has risen and then fallen to 90 degrees (which will be in from five days to two weeks), the hotbed is ready for planting. Hotbeds should be watered and ventilated every day and their glass coverings should be raised to prevent the

evaporation of the soil moisture, and will prevent the cold water from hose or watering can from injuring the roots. In addition, a large number of roots will form in these mounds, anchoring the plant firmly in the soil and making it almost impossible for a strong wind to uproot them. Such hills in a row also form the sides of shallow troughs that prevent the water from running off the bed.

The tools required for a small garden include a spade, a hoe, a rake, a hand weeder, and a length of stout cord to guide you in placing your rows in orderly, straight lines. With these, a little interest, and intelligent care, the most inexperienced gardener will achieve astonishing results.



After the soil has been worked, rake the bed smooth, removing all rocks and pebbles

intense heat that is produced in them on fair days from harming the plants. Plants started in a hotbed, of course, must be transplanted to the garden later in the season.

Regarding the intensive cultivation mentioned before, the first crop from your garden should consist of early vegetables, such as beets, spinach, radishes, and lettuce. After these have been harvested, say in May or June, the ground from which they have been taken may be replanted with late vegetables, after it has been thoroughly worked and fertilized. Early and late vegetables also may be planted together fairly early in the season, the late varieties being planted between the early rows.

Watch and Weed

After watering your garden and after every rain, see that the soil does not crust over and crack open. If this occurs, the whole garden should be thoroughly hoed to loosen the soil. This will also give a splendid opportunity to remove weeds. Weeding, of course, should be performed regularly, since weeds are intruders and robbers that steal from the soil the nourishment your plants require.

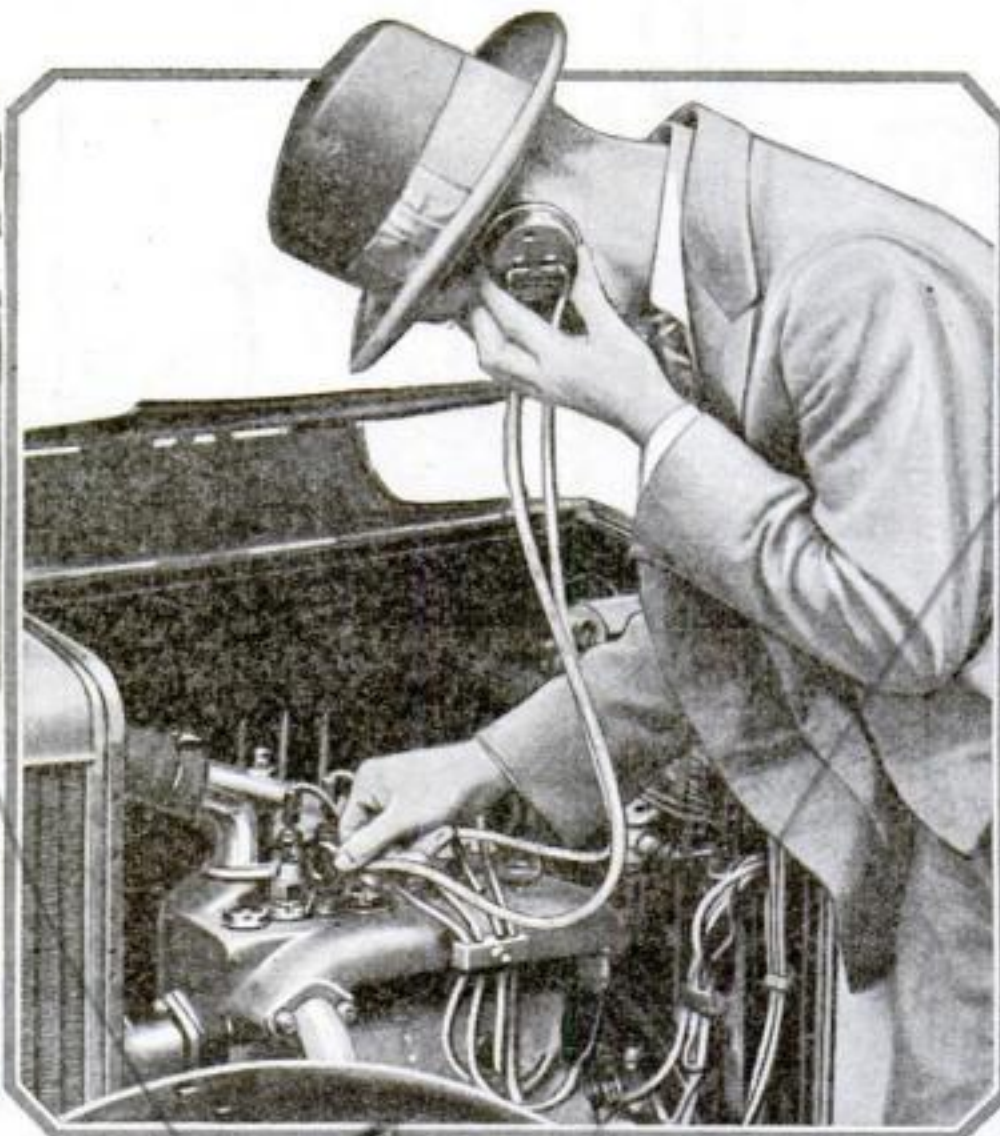
Little hills or mounds of soil made with the hoe about the lower stems of such plants as beans, peas, potatoes, cucumbers, tomatoes, pumpkins, cabbages, Brussels sprouts and celery, will protect the plants from too rapid

IT WOULD save trouble and expense, wouldn't it, if coal could be piped from the mines direct to your furnace, just as electricity and gas now are delivered from central stations? Read, in next month's issue, about the recent successful experiments with "black flour," the world's newest fuel.

New Additions to Car Enjoyment



One of the new devices to shield the driver's eyes from oncoming headlights is a semi-transparent plate attached to the windshield. While baffling glaring rays, it does not obstruct vision.



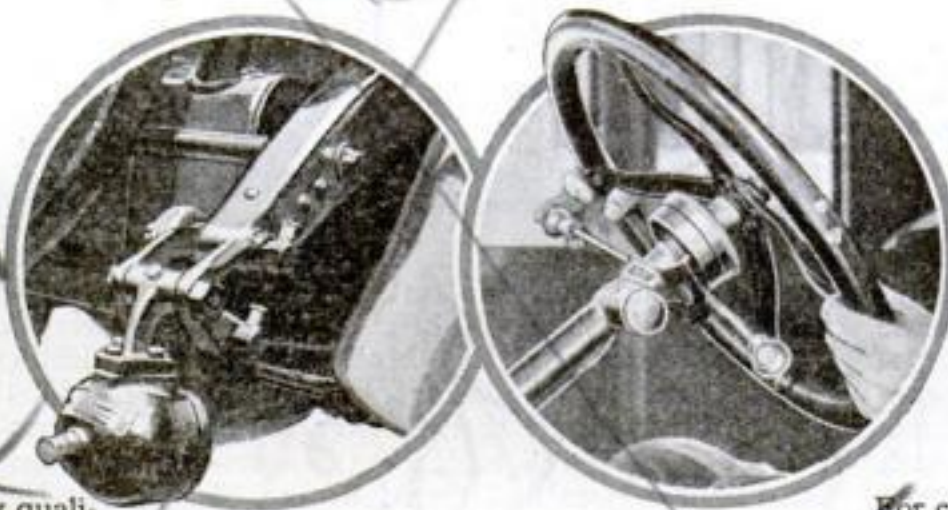
Identifying a troublesome spark plug has been made easy, it is claimed, with this phone detector. The tips of the wires are touched to the plug. The strength of the sound then indicates the strength of the spark.



Unusual resiliency, shock-absorption, and increased tire mileage are claimed for this new type of spring wheel. The hubs are flexibly suspended, giving a sort of floating wheel action.



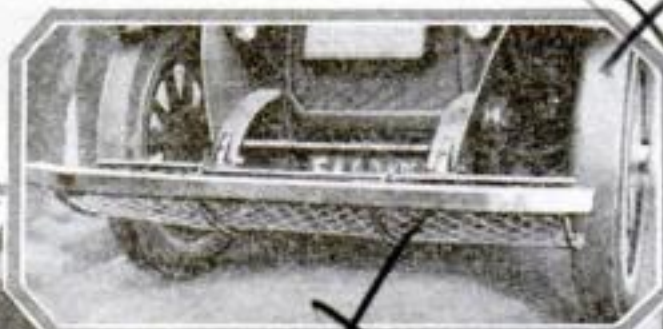
Smoking convenience while driving is provided by the three compartments of this compact cigarette case. One compartment holds cigarettes that protrude when the lid is raised. The other compartments are used for the matches and ashes.



Depending on the cushioning qualities of an inflated rubber ball, the new shock absorber shown at the upper right replaces the spring shackles. The ball is inflated like a tire.



The car that is stuck fast in a mud hole can climb out under its own power, it is claimed, with the aid of this emergency mud shoe. It holds six spikes bordered by two chisel-like ridges.

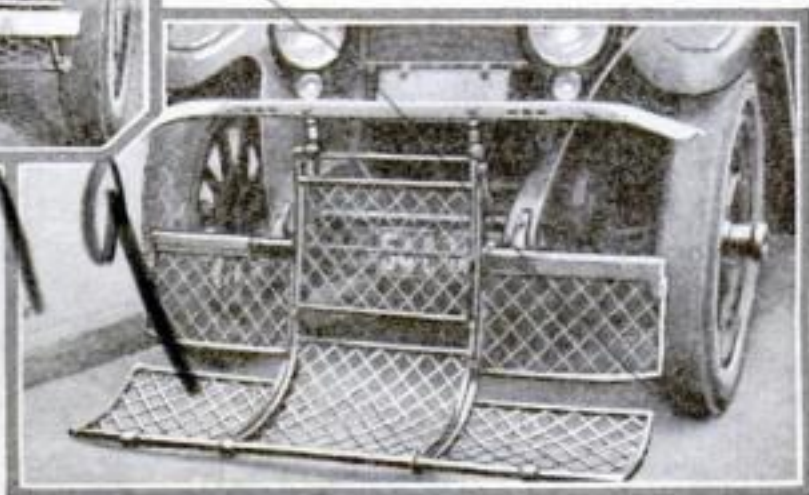


Combining neat appearance with effective action, a new safety bumper remains inconspicuously collapsed, as shown above, until it strikes an object or until released by the driver. Then it drops to the position shown at right.



A safe and comfortable auto ride for the baby is the purpose of this folding canvas chair, attached to the front or back seat of the car with straps.

For convenient manipulation of gas and spark levers, small rubber knobs have been designed to slip over the ends of the levers, providing a quick, easy hold for the fingers.



Less than two pounds pressure is required, it is claimed, to release the safety fender, which is said to open at the instant of impact.

Are YOUR Headlights Dangerous?

How to Stop the Blinding Glare that Invites Disaster at Night

By F. A. Platte

Instructor, Department
of Physics, Columbia
University

CRASH!

I stopped my car, and peered back into the night. Two cars were locked together in the middle of the road. I put my motor in reverse and backed up to them, believing I should have to carry some one to the hospital; but I was relieved to find that damage had been done only to the cars. Each driver was blaming the other for the accident, and it was some time before I learned what actually had happened.

Dazzled by the other's glaring headlights, one driver had been unable to see the road before him, and had headed his car directly into the other.

Who was to blame? There could be only one answer. It was the driver who, through ignorance, carelessness, or selfishness, had operated the car with glaring headlights.

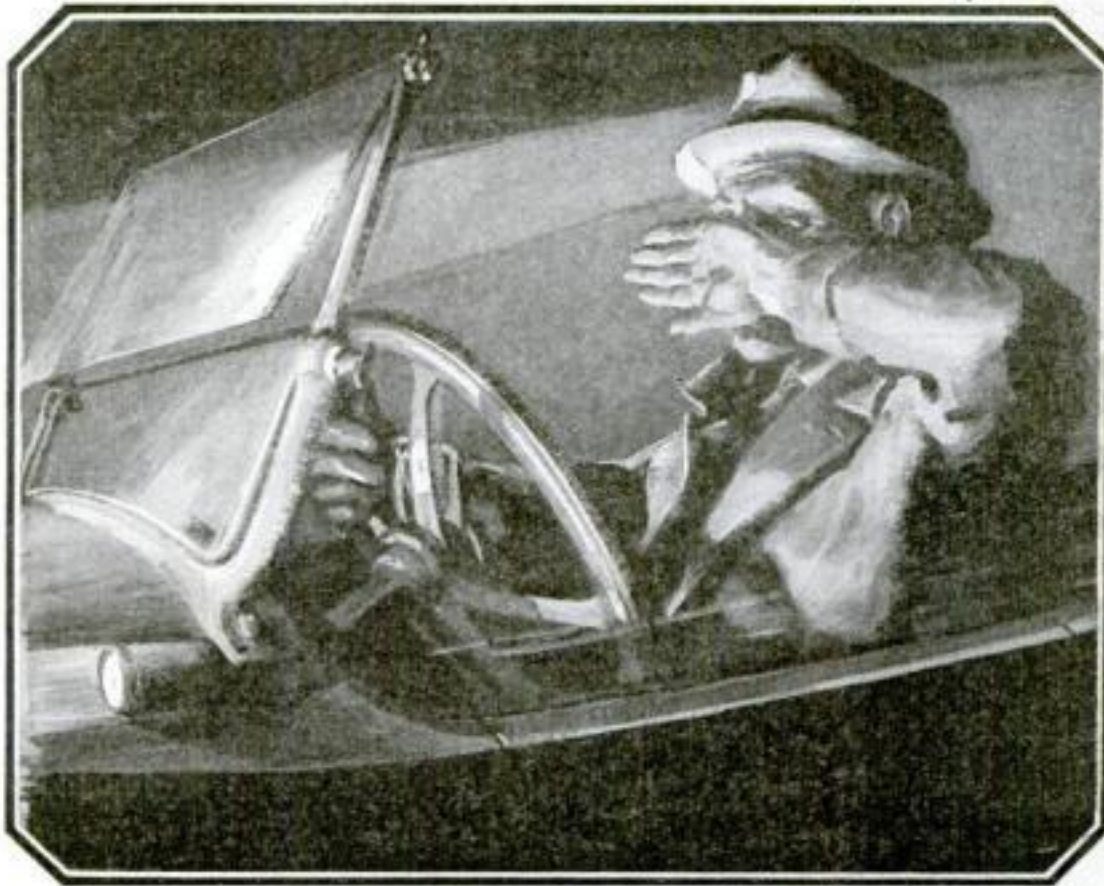
Bright Headlights Confuse Drivers

Every motorist has experienced the inconvenience and worry of night driving caused by approaching cars with headlights that throw blinding beams into his eyes. If the glare is especially bright, a driver virtually loses his sense of direction, and, if inexperienced, is likely to swerve his car unconsciously and to meet disaster. In fact, even an experienced motorist cannot feel absolute security against the menace of the glaring headlights of other cars.

Glaring headlights are unnecessary, and they are almost as dangerous to the car that carries them as to the cars that may be passed, for, when your headlights dazzle another motorist, it is more than likely that it will be *your* car he will hit. So for your own safety you should make sure your headlights are properly adjusted.

Inspect and Adjust

Periodic inspection and adjustment of the headlights are essential to the elimination of glare. These operations are simple and require little time. Two things are to be considered—the proper location of the



If your headlights cast a blinding glare into the eyes of the other fellow on the road, you are inviting disaster not only to him but to yourself. The pointers below will help to insure you against this danger

1. Be sure each lamp is in focus.
2. See that each light beam is directed so that the top of the beam is at the level of the lamp.
3. Equip the lamps with anti-glare lenses.
4. Be sure the lenses are right side up.
5. Use lamp bulbs of not more than 21 candlepower.
6. Examine and test your headlights frequently, according to directions on these pages

lamp in its socket and the angle at which the light beam leaves the lens.

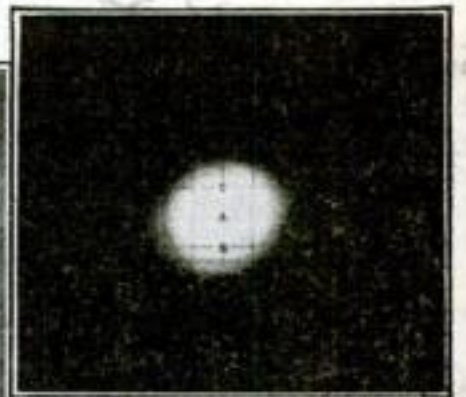
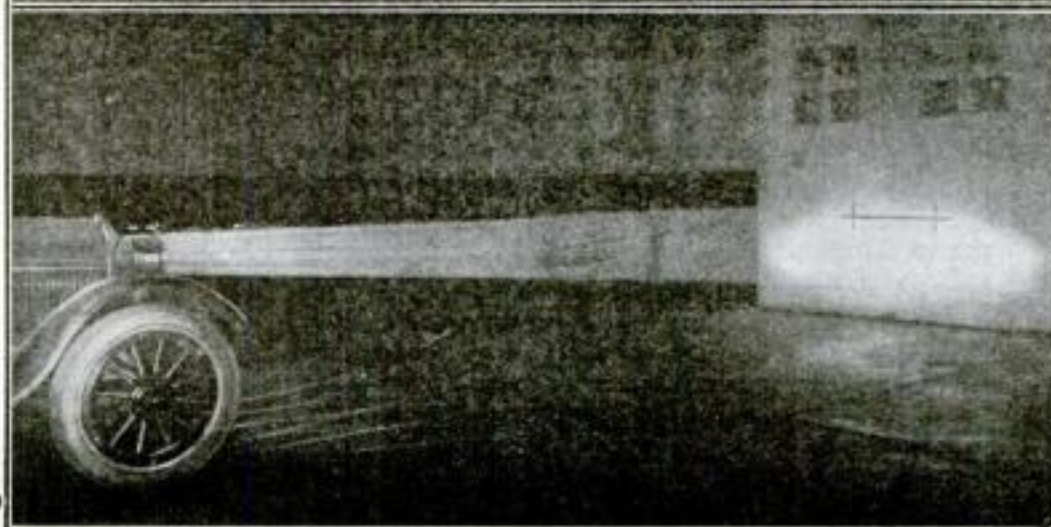
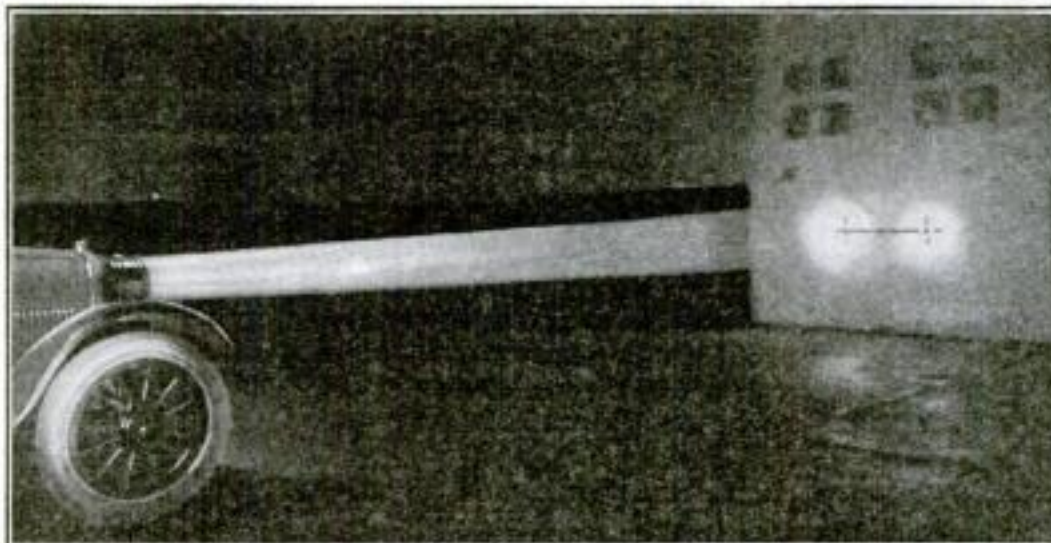
To determine whether the lamps are properly focused, drive the car, fully loaded, toward a wall or other flat, vertical surface and stop about 75 feet away. A shorter distance will serve, but it should not be less than 25 feet.

To Test Lights

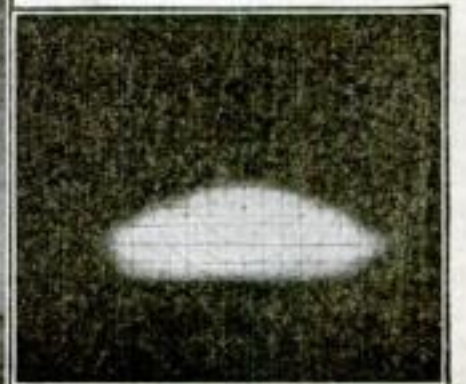
Now remove the lenses. Cover one lamp and note the shape and size of the reflection that the other casts on the wall. Turn the screw or other adjusting device with which your lamp is equipped until you have produced the smallest and clearest possible reflection on the wall. This reflection, to be most efficient,

should be circular in shape.

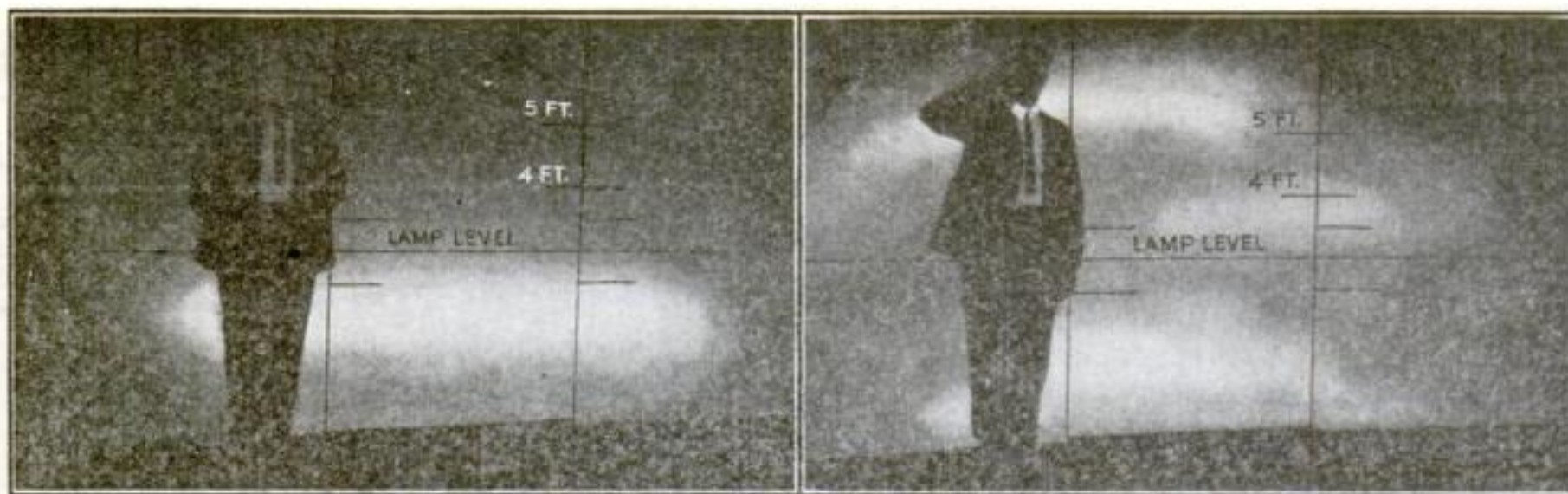
That lamp now is in proper focus. By turning the adjusting screw, you have moved the lamp backward or forward until it has reached the particular point in relation to its reflector that is called the focus. When the lamp is in this position, all rays of light emerge from it in parallel lines. When the lamp bulb is in front of the focus, the rays cross; when in rear, the rays diverge. In either case in which



Above: Reflection of a correctly focused headlight with lens removed. At the left: Round reflections from both lamps, when correctly focused



Above: Oval reflection, correct focus, with lens in place. At the left: Correct combined reflections



Correct headlight reflection at a distance of 25 feet, produced when lamp bulbs are at focus, as in Fig. 1 at the right. The top of the reflection is at automobile lamp level

Dangerous headlight reflection, at a distance of 25 feet, produced when lamps are out of focus, as in Figs. 2, 3, and 4, below. The rays that mount above lamp level are dangerous

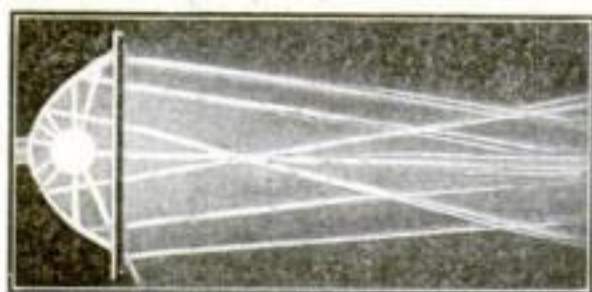


Fig. 2. Ahead of focus; rays converge



Fig. 1. Lamp bulb at focus; rays parallel

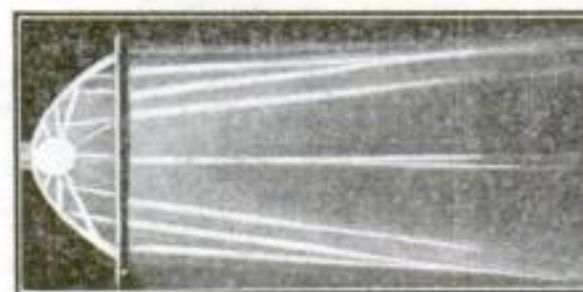


Fig. 4. Behind focus; rays diverge



Fig. 3. Below reflector; rays scattered

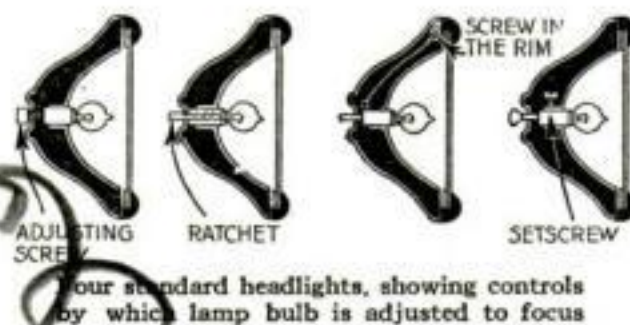
the lamp is out of focus, the reflection on the wall will be a large ring and not a small, solid round spot. The rays that compose the upper portion of this large ring are the dangerous ones that are projected into the eyes of approaching motorists. Adjust the second lamp in the same way.

Having completed these adjustments, replace the lenses on the lamps, making sure that they are right side up. Immediately the reflections on the wall become oval in shape. The reflections of lamps should combine to produce a flat oval reflection. When this is obtained, the lights should be adjusted for height of beam. The top of the beam should be at the level of the lamps, or at about the height of the waistline of a grown person. With a light car this level should be even lower, for when several heavy people enter the car, their weight tilts the front end.

Correct Headlight Angle

Most cars are provided with an adjusting device to tilt the headlights. If your car is not provided with an appliance of this sort, you must bend the lamp brackets until the proper beam level is obtained. If when you sit in your car, you can see with reasonable clearness the head or neck of a person standing from 25 to 75 feet away, the beam cast by your lights is too high. Either the focus must be changed, or the lamp must be tilted down.

In addition to the two all-important considerations mentioned above, the lights can be improved further by



Four standard headlights, showing controls by which lamp bulb is adjusted to focus

using anti-glare lenses and polishing the reflectors with a soft cloth dipped in powdered lampblack. The various makes of special anti-glare lenses are of two kinds

—diffusing and deflecting. Diffusing lenses resemble ground glass and scatter the beam. Deflecting lenses merely take those beams that project upward and bend them down so that none will rise above the lamp level. Although most of these devices will accomplish the desired purpose, there are some which bend the rays down so much that they strike the road just in front of the car. While this eliminates glare, it also eliminates a good view of the road.

Another important consideration is that the lamps be of proper candlepower. Too intense a light from the lamp will produce too sharp a beam. Even though this may not shine directly into the eyes of an approaching motorist, it may be strong enough to cause him annoyance.

If you follow these precautions, you will find you have an ideal light preceding your car—one that will illuminate objects sufficiently; one that will throw its brightest rays on your side of the road; and sufficiently close to the car to see the road ahead; one that will permit you to view the full width of the road for at least 200 feet, but without casting a dangerous light into the eyes of other drivers.

Furthermore, you will be spared the annoyance of continually turning on and off your lights, a dangerous practice in itself.

IN ANOTHER useful article next month, Mr. Platte will tell how you can get more miles to a gallon of gasoline.

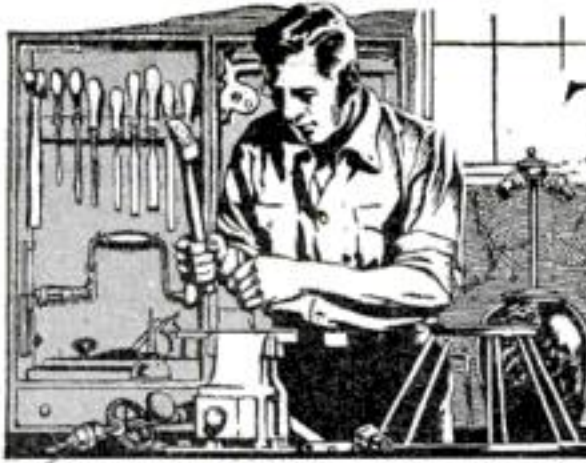
Know Your Car

The Valve Inside.—This small, but important piece of mechanism, consisting of a plunger faced on one end with a rubber plug and surrounded at the bottom by a small spring, plays a vital part in the life of your automobile tire. Inclosed within the tire valve stem, it is the mechanism that opens to permit the entrance of air during inflation, and automatically closes to hold the air within the tire tube during service. In large pneumatic tires it is called upon to hold back a pressure of more than 100 pounds, a pressure that increases with severe road jars.

During inflation, air pressure from the pump forces the plunger inward against the spring. As soon as this pressure is released, the spring forces the plunger back into position, where the rubber plug acts as a washer to prevent escape of air from the tire.

The valve cap always should be screwed firmly over the valve stem to keep out dirt and to provide a secondary seal against escape of air.





The Home Workshop

Arthur Wakeling, Editor

Chinese Game Table Has Every Playing Aid

COLORFUL, picturesque, and fascinating as is the ancient Chinese game that has become, under its many aliases, one of the leading indoor pastimes of the country, it is doubly enjoyable when played at a properly equipped table.

Many costly sets are being used on rickety card tables with loose tile racks that do neither the game nor the set full justice. The table should be especially built for the game, with convenient racks and counter holders and a felt-covered playing surface for building the wall of tiles; and it should have a finish and style to match the workmanship and appearance of the Chinese pieces and beautiful cabinets in which they are stored. Such tables can be purchased for prices ranging from \$25 to \$75 or more. The cost of making them, however, is very much less, especially as expensive hard woods need not be used.

The table illustrated, which was designed by George F. Kaercher, of Philadelphia, a furniture factory



Fig. 1. The shop details of this attractive piece are contained in POPULAR SCIENCE MONTHLY'S Blueprint No. 32

The foundation of the table top is a base made of four pieces of white-wood $\frac{1}{2}$ by $3\frac{1}{4}$ in. by 2 ft. $11\frac{1}{8}$ in., mitered and doweled together to form a frame. To one flat under surface of this frame is hinged the pair of longer legs with $1\frac{3}{4}$ by $2\frac{1}{2}$ in. hinges. To the rail that connects the other two legs is screwed a hinged filling piece $\frac{1}{2}$ by $1\frac{1}{2}$ in. by 2 ft. 7 in. Two hinges are fastened to this filling piece and also to a heavy block $1\frac{3}{4}$ by $3\frac{3}{4}$ in. by 2 ft. $10\frac{1}{2}$ in. This block, which lies flat against the under side of the table frame, is notched out, as shown in Fig. 3, to permit the ends of the legs on the other side to enter it when they are folded.

The rim of the table is made of four pieces $\frac{7}{16}$ by 4 in. by 3 ft., mitered and doweled. The top and bottom outside edges of these pieces are beaded to give a finish corresponding to the legs.

The racks, which are fastened to the rim, as shown in Figs. 1 and 2, are shaped from pieces $1\frac{5}{16}$ by $1\frac{5}{16}$ by 1 in., with ends cut from pieces $\frac{5}{16}$ by (Continued on page 118)

superintendent, combines all the qualities desirable for comfort and convenience in playing the game and at the same time has the appearance of fine workmanship and finish sometimes lacking in even expensive commercial tables.

While the table shown in the central illustration (Fig. 1), will fold up and can be stored away in a relatively small space, it is of substantial construction throughout. Non-folding variations of the same design are equally practical, in which case legs of any of the three types shown in Fig. 2 are alternatives for the plainer legs illustrated in Fig. 1.

The racks for the tiles are fastened to the rim of the table. The counter holders are semicircular troughs or bins that run around the edge. Ashtrays are also provided for the convenience of those who like to smoke while playing.

The top is 3 ft. square, the overall height is 2 ft. $8\frac{3}{8}$ in. The legs, like all the other parts, unless otherwise noted below, are maple, oak, or poplar. They are $1\frac{3}{4}$ in. square and two of them are 2 ft. $6\frac{5}{8}$ in. long, the other two being 2 ft. $4\frac{7}{8}$ in. The corners of the legs are relieved by being beaded, as shown in Fig. 2, but other styles have the square legs with the edges only slightly rounded or plain tapered legs.

The two longer legs are connected by a rail $\frac{1}{8}$ by $6\frac{1}{2}$ in. by 2 ft. 7 in., to which each is fastened with three $\frac{3}{8}$ -in. dowels. The two shorter legs are similarly fastened to a rail $\frac{1}{8}$ by $4\frac{1}{4}$ in. by 2 ft. 7 in.

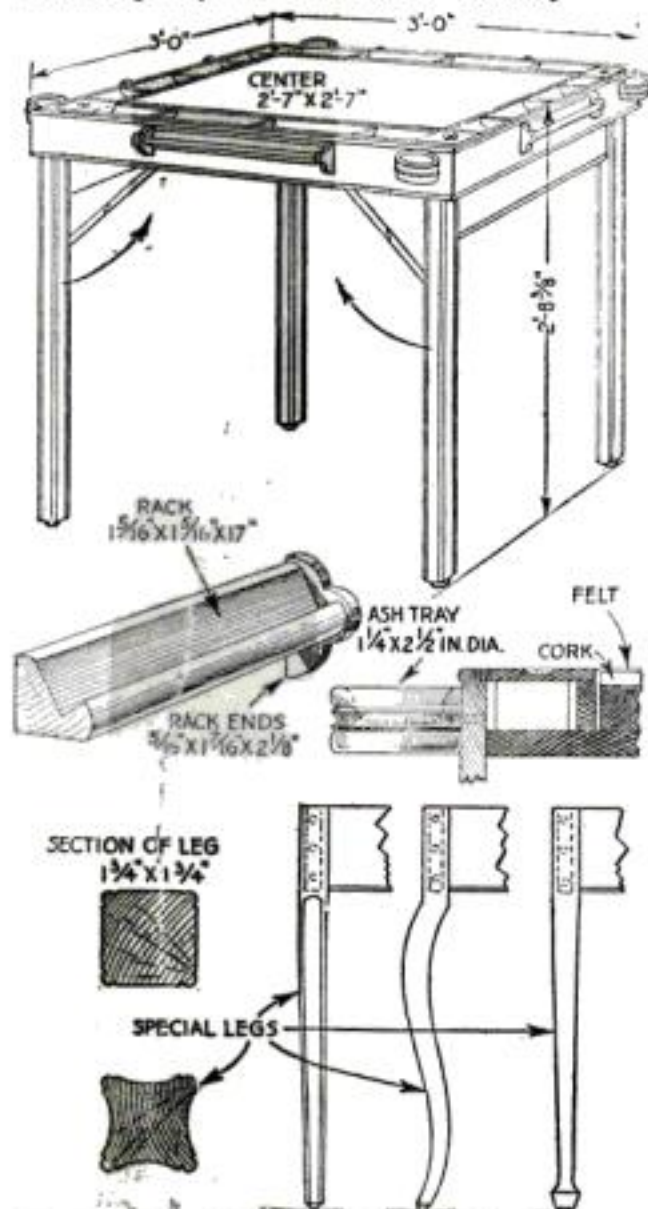


Fig. 2. The table, three alternative leg designs, and details of racks, corner bins, and ashtrays

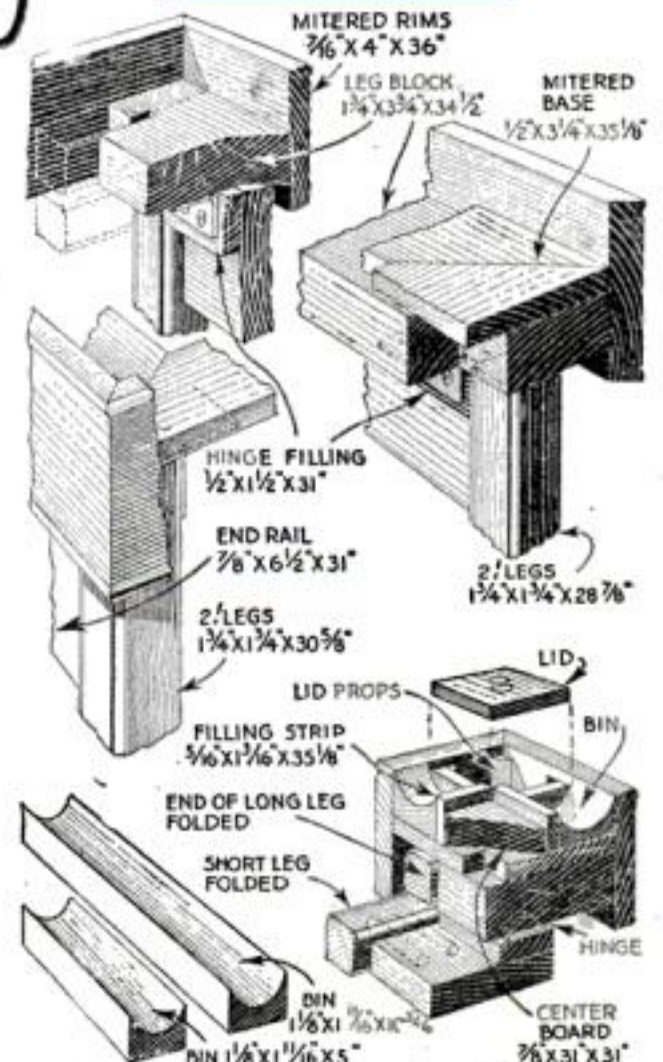
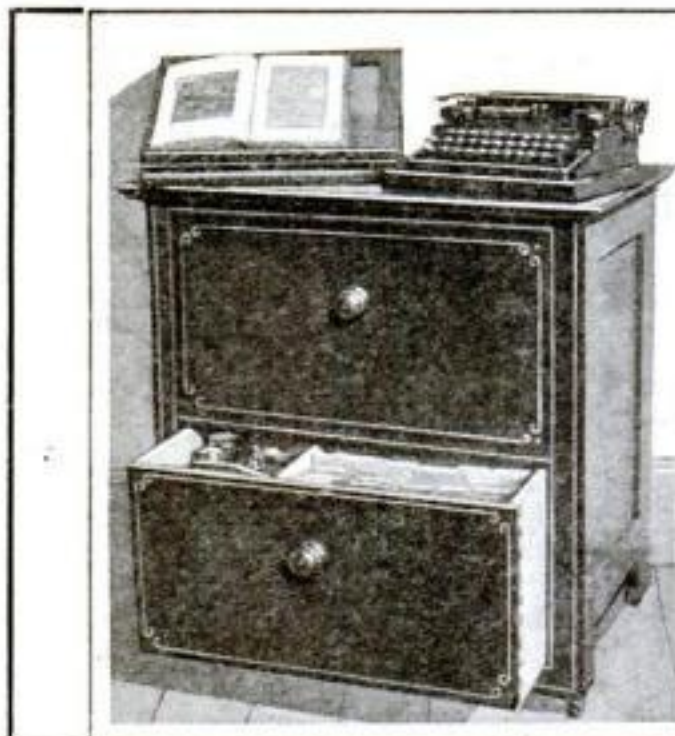


Fig. 3. The corner construction with legs open is shown at top, and with legs folded, below

New Furniture Salvaged from Old



By Capt. E. A. McCann

MY POSITION was perhaps a little unusual, though it is the kind of thing that, with variations, is likely to happen to many. I took one floor of a house that was being reconstructed and found therein six bureaus and commodes, all very dilapidated and apparently only fit for kindling-wood. They were, however, made of good oak, and it struck me that they might be converted to my uses, thus saving the buying of new furniture, which would most likely not be so suitable and certainly would not have the same interest for me.

Two of the chests of drawers I cleaned thoroughly with ly and carbolic, sandpapered, tightened up the screws a bit and enamelled to go with the color scheme of the room. As this room had not too much light, I papered the walls a corn color, used bright blue curtains and cushions, and enamelled the furniture a rich, tawny yellow, with a pale blue stripe.

One of the bureaus was a small sawed-off highboy. In this I left the lower batten and drawer-slide and shifted the middle one halfway between. Then, from the old drawers, with the addition of some spare wood, I made two drawers and partitioned them so that one side of each would take letter folders.

The balance of the space in the top one was left for a card index, envelopes,

Above, at left: A rebuilt stationery cabinet. Center: A dresser and (at right) the dilapidated commode from which it was built

notebooks, and the like, and in the bottom drawer I put a slide halfway up to take ink and other bottles, rubbers, and writing materials, with room below for compasses, and other drawing equipment. I put easy running casters on this and now have a handy cabinet for my writing material, which I can either work on or, better, draw up to the table. This saves me a lot of walking about.

The bookrack on top is made from a piece of packing case with a nice grain, stained green. It is just two frames about 14 by 10 in. hinged together in front, with hinged legs on either side and a narrow ledge in front.

One of the commodes I made into the little Welsh dresser shown by fitting a new door on the left and raising the back with shelves. I used the posts and panels at the sides of the shelves to carry out the same pattern as the sides below. The back I panelled quite flat with $\frac{3}{8}$ -in. whitewood. The shelves are of oak from

another piece with narrow battens to keep the plates from slipping.

This piece I painted to match with the same blue stripes, but with the addition of designs on the doors and drawer, as they looked rather blank. The motif below is based on hunting implements, because that is where the food is kept, but on the drawer it is weapons, as a warning, because the "near" silver reposes there. With blue and white china, ranging from 10 cents a piece to valuable Chelsea and Chinese, it looks fine.

I kept all the furniture short, as the ceiling is not very high. One must always think of these things when furnishing.

The handles all through are just cheap pierced brass, but I enamelled them blue and then rubbed off the high lights with a cloth pad so that they have the polychrome effect.

Thus it will be seen that with some ingenuity and the aid of simple tools and paint or, if you prefer, stain and varnish, many apparently worthless pieces of furniture can be made into something quite handsome, that will be much nicer, at any rate to you, than what you buy ready made, and the saving is considerable.

Incidentally, in the basements of most apartment houses and many homes may be found quantities of dilapidated furniture that may be had for a smile, perhaps aided in some cases by a small tip.

Boys Enjoy Speedy Coasting with Roller-Skate Scooter

By Dale R. Van Horn

FUN in roller skating on smooth pavements is doubled with this light, speedy, one-wheel scooter. Carrying it, the skater speeds along as fast as he can go. Then he swings the scooter between his legs, sits down on the seat, and, with the knee rest upon his knees, coasts as far as the momentum will carry him.

The materials can, for the most part, be salvaged from the scrap pile. The hardwood wheel is 4 in. in diameter and 1 in. thick. It will have



Built from wood picked up from the scrap pile, this unique scooter adds immensely to the sport of roller skating



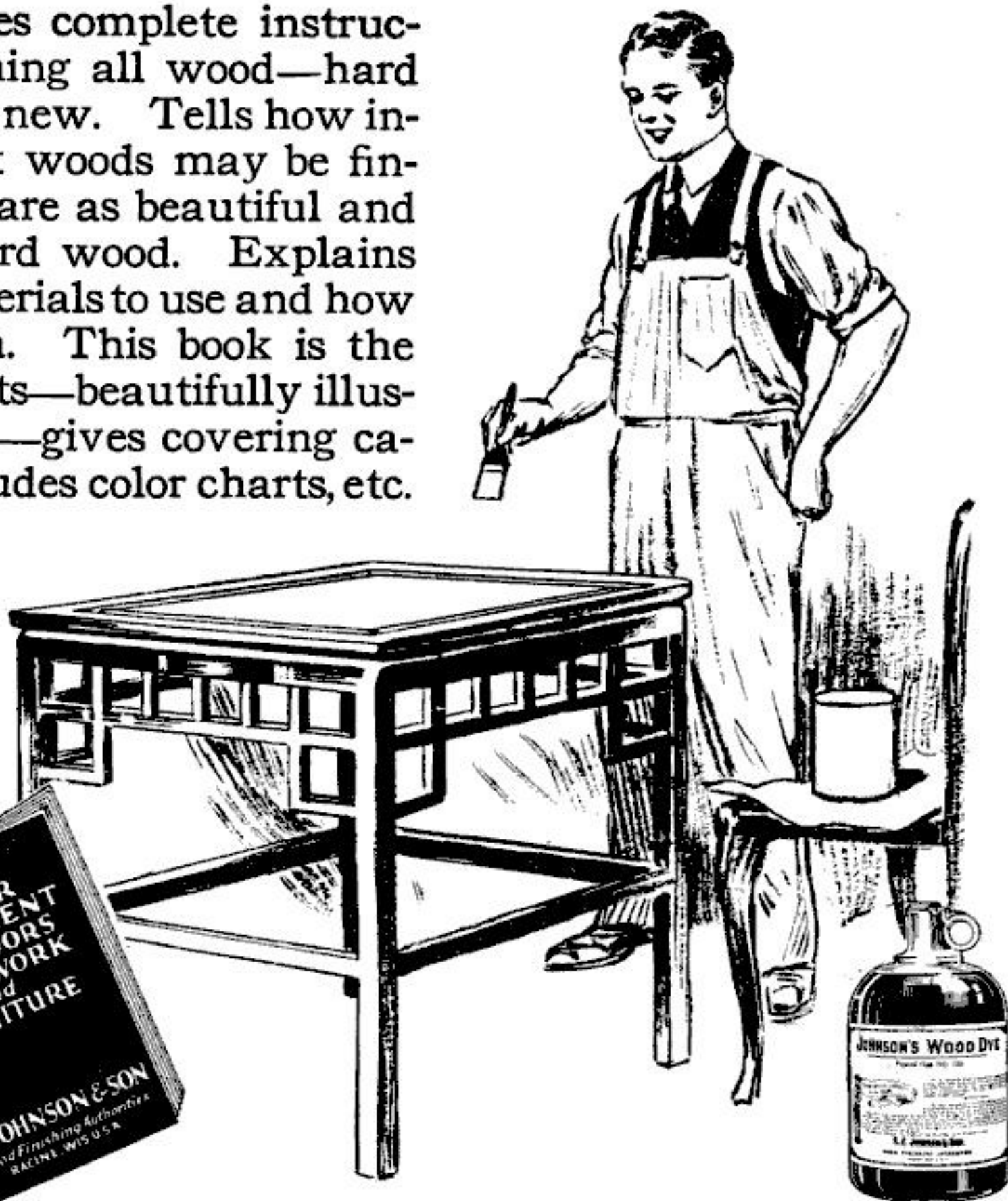
to be turned in a lathe, cut with a keyhole saw, or shaped with a chisel after the stock has been mounted on any revolving spindle. The main bar should also be of hard wood, although this is not absolutely necessary, and the joints should be screwed.

The accompanying illustration shows how the parts are assembled, and how each is shaped. When painted in bright colors and carefully finished, this device will insure any boy many hours of happy outdoor sport.

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How to Construct a Modern Built-In Buffet

By Edwin M. Love

MANY recently constructed houses have built-in buffets, dining alcoves, bookcases, and the like, but the majority of small dwellings have none of these conveniences. Perhaps nothing in woodworking brings greater satisfaction to the home mechanic than the building of features of this kind, which are well within the ability of any man who can make good joints in wood.

The buffet illustrated is a recent design that has proved popular in new houses. As it stands out in the room rather than in a recess, it can be built into an old house as easily as in a new.

The construction is relatively simple. No elaborate cabinet work is necessary; in fact, all the joints are nailed except those in the doors, and the doors usually can be obtained quite reasonably at a sash and door mill. Wood to match the trim of the room should be used if the buffet is to be varnished, or pine or any easily obtainable soft wood, if it is to be enameled.

Once the method of building the buffet is understood, it is easy to modify the proportions and design to suit any given room. The one illustrated is in a large dining-room and its proportions are generous. The top or countershelf is 2 ft. by 6 ft. 8 in.; the height of the buffet proper is 3 ft., and the mirror back extends 1 ft. 6 in. more, making the total height 4 ft. 6 in.

The mirror is the most expensive item, in this case costing \$18. The lumber cost \$14.50, the doors \$7, and the hardware \$2.20. The building time was 30 hours.

Draw on the floor the outline of the frame of the buffet, making the length 6 ft. 6 in., the width 20 in. at the ends and 23 in. at the partitions. The partition lines are spaced 1 ft. 6 in. from each end and like the end lines are squared out from the wall. Nail cleats on the floor $\frac{3}{4}$ in. inside of each end line, and $\frac{3}{8}$ in. to the side of each partition line, and plumb up lines on the wall from these.

Glue up the counter shelf, ends, and partitions, using corrugated joint fasteners every 12 in. on the under side. While the glue is drying, nail on the wall cleats. Measure up from the floor 2 ft. 11 in., and level across. Nail a 1 in. by 3 in. cleat to the wall with eightpenny nails, being careful that the ends do not project beyond the end plumb lines. Lay off the following distances from the top of this cleat downward: 4 in., 4 in., $2\frac{1}{2}$ in., 4 in., $2\frac{1}{2}$ in., $5\frac{1}{4}$ in., $2\frac{1}{2}$ in., $5\frac{1}{4}$ in. Rough $2\frac{1}{2}$ -in. cleats are leveled across from these points to support the rear ends of the drawer slides, as shown in the perspective illustration of the frame.

When the glue-up stock is dry enough, surface the end pieces and partitions and scribe them to the wall, being sure to keep the front edges plumb. Nail to the floor cleats and tack a brace across the tops to keep the pieces in position.

The hanging stiles are next cut to length, the corner stiles mitered to the ends, and the drawer stiles shaped to the proper angles by plan-

narrow strips are cut between the upper rail and cleat to prevent the upper drawers from sagging when opened. At the back end of each slide nail a block to the wall as a drawer bumper so as to prevent strain on the edges of the drawer fronts.

Nail 1 by $1\frac{1}{2}$ in. shelf cleats to the ends and partitions, placing the lower cleats so that the shelves will project $\frac{1}{2}$ in. above the bottom rails to form door stops. The upper shelves should be 1 ft. 6 in. above the lower. Counter-shelf cleats are put in as indicated.

Surface the counter shelf, flatten the under side where it bears against the cleats, cut to a length of 6 ft. 8 in., and scribe to the wall. Nail securely to the cleats, and then cut and dress the front edge, allowing a projection of 1 in. beyond the stiles and rails. In putting on the wainscot cap edging, allow a $\frac{1}{4}$ -in. margin on shelf. Make all the angle joints accurately and glue

as well as nail them securely. Fit the 2-in. cove underneath; then fit the base and shoe.

The mirror frame is mitered. Except at the top, where 3-in. stock is used, the frame is 1 by $1\frac{1}{2}$ in. Before installing the mirror, paint the molding, as the back edge will be reflected in the glass.

In hanging the doors, be careful to allow about $\frac{1}{16}$ in. all around for clearance if the buffet is to be painted. If it is to be varnished, the clearance may be a little less.

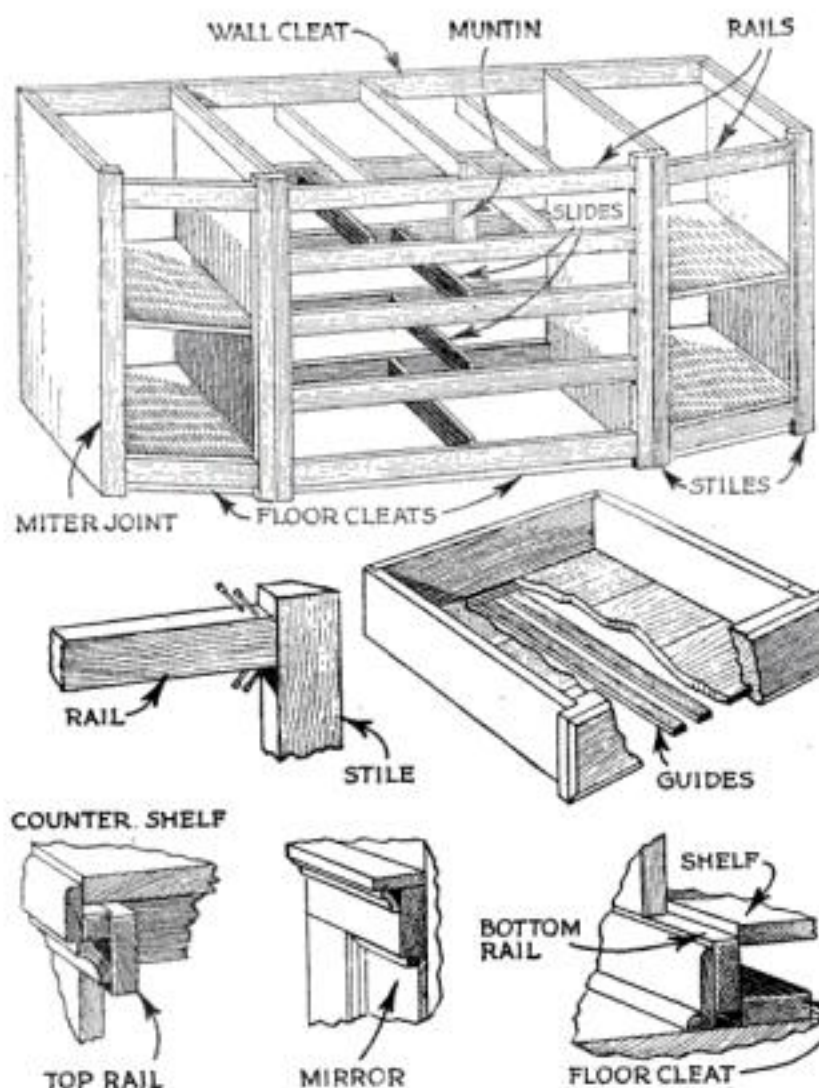
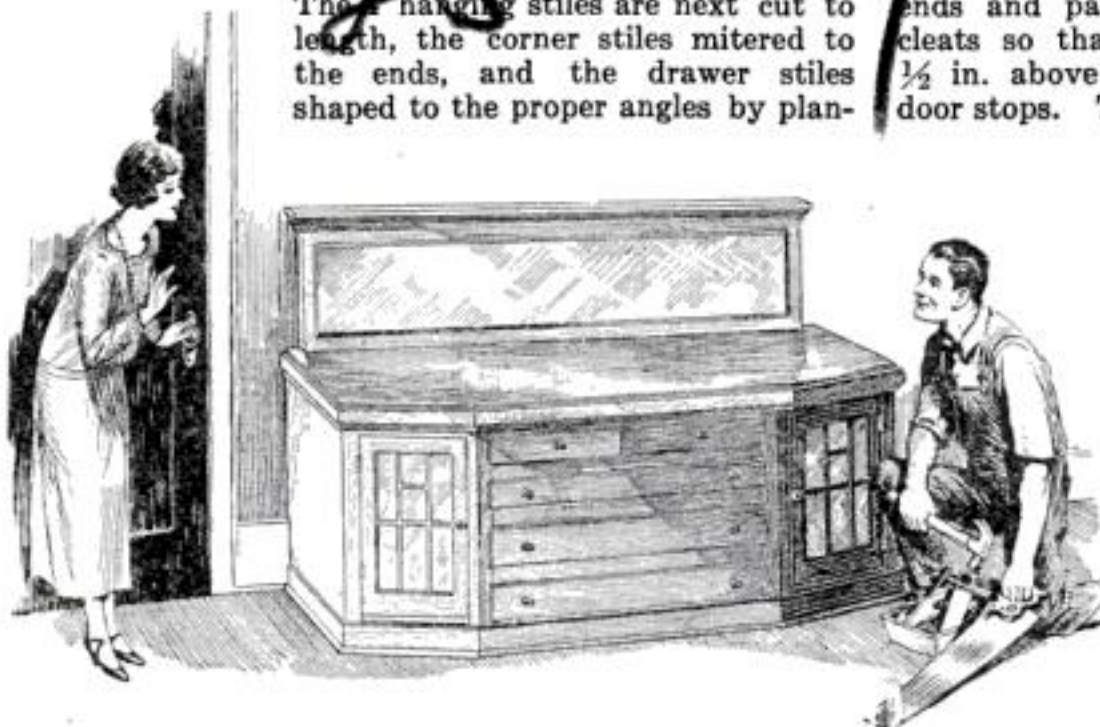
All the woodwork should be carefully scraped and sanded before finishing in either varnish or enamel, as the least rough spot, plane mark, or open joint will show.

Hardware, other than the hinges used for hanging the doors, should not be put on until the finishing is complete.

The bill of materials follows:

- 3 pc. $1\frac{1}{2}$ by $2\frac{1}{2}$ in., net, by 16 ft., "s4s" (surfaced on all four sides.)
- 1 pc. $1\frac{1}{2}$ by $1\frac{1}{2}$ in. by 12 ft., "s4s"
- 1 pc. 1 by 3 in. by 14 ft., "s4s"
- 2 pc. 1 by $1\frac{1}{2}$ in. by 12 ft., "s4s"
- 3 pc. 1 by 12 in. by 12 ft., "s4s," for shelves and ends
- 1 pc. 1 by 12 in. by 14 ft., "s4s," for counter-shelf
- 1 pc. 1 by 6 in. by 14 ft., "s4s," for drawer front
- 2 pc. $\frac{5}{8}$ by 6 in. by 10 ft., "s4s," for drawer sides and backs
- 24 sq. ft. of $\frac{3}{8}$ -in. drawer bottom
- 1 pc. $\frac{3}{4}$ by 16 ft. quarter round, mirror molding
- 1 pc. $1\frac{1}{2}$ by 8 ft. cove, for mirror shelf
- 1 pc. 2 by 12 ft. cove, for counter shelf
- 1 pc. $\frac{3}{4}$ by $\frac{3}{4}$ in. by 12 ft., base shoe
- 1 pc. $\frac{5}{8}$ by $2\frac{1}{2}$ in. by 12 ft. wainscot cap
- 1 pc. $\frac{5}{8}$ by 4 in. by 12 ft. baseboard
- 1 pc. 1 by 6 in. by 18 ft., sheathing to be ripped down center for floor and wall cleats, drawer slides, etc.
- 2 sash doors to fit openings
- 2 pair $2\frac{1}{2}$ by $2\frac{1}{2}$ in. loose pin butts, dull brass
- 50 corrugated $\frac{5}{8}$ -in. steel fasteners (clamp nails)
- 10 drawer knobs for drawers and doors
- 2 forge catches
- 1 12 by 75 in. plate mirror

In ordering, it should be remembered that surfacing of finished stock reduces the actual dimensions $\frac{1}{4}$ in. to $\frac{3}{4}$ in. below sizes ordered, unless marked "net."



The completed buffet, the general construction of the frame, and details of drawers, countershelf edging, mirror cap, base molding, and method of nailing together rails and stiles

ing a bevel on one half of the width only. The thinner edges are placed on the drawer side.

Cut the rails between the stiles, getting the positions by leveling across from the tops of the cleats. Toenail the joints with 4 sixpenny finishing nails, as shown, and nail in the muntin.

The drawer slides, made of 1 in. by 3 in. stock, are placed in the center of the drawer openings, the upper edges projecting above the rails $\frac{1}{2}$ in. Two

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Better Shop Methods

How Expert Mechanics Save Time and Labor



Speedy and Accurate Ways of Boring

ERROR in machining. Score in finished bore of cylinder casting. Mechanic Joseph Dyson. Hired Feb. 20, 1922. Reported for inspection and action."

This report was the signal for the dismissal of mechanic Dyson. He had not studied the methods of finish boring very carefully and as a result had used too little lubricant. This ruined the casting and he lost his job.

While most mechanics know something about tools for enlarging and finishing cylindrical openings and realize that various kinds of boring tools are available, there are few who have studied boring operations sufficiently in relation to speed and accuracy. Many machine hands are lost when it comes to finish boring holes of large diameter or in work of unusual character.

Before starting a boring job, the mechanic should analyze the situation and decide on the type of tool that will give the best results. He must then see that all the cutting edges are in good condition. A proper holder must be selected so that the tool won't slip and gouge the work. Lastly, he must make sure that the proper kind of lubricant is fed to the cutting edge in sufficient quantities to insure best results.

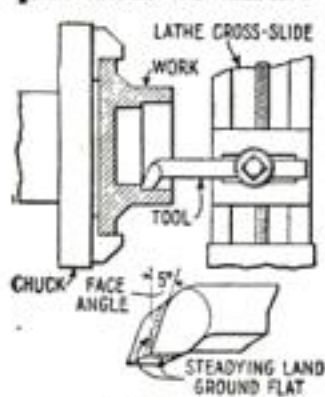


Fig. 1

A dependable practice for lathe boring is a fixed cutter in the tool-post of the cross-slide. It must be sufficiently long, as shown in Fig. 1, to make the complete bore without shifting the tool. The angular shaped nose of the tool

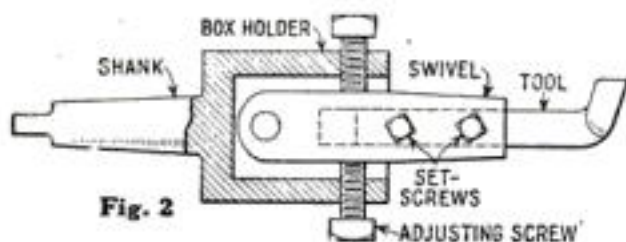


Fig. 2

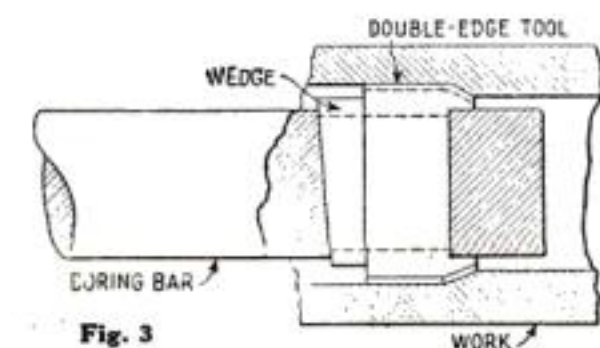


Fig. 3

Typical lathe boring tool, adjustable boring tool, and a simple double-edged cutter

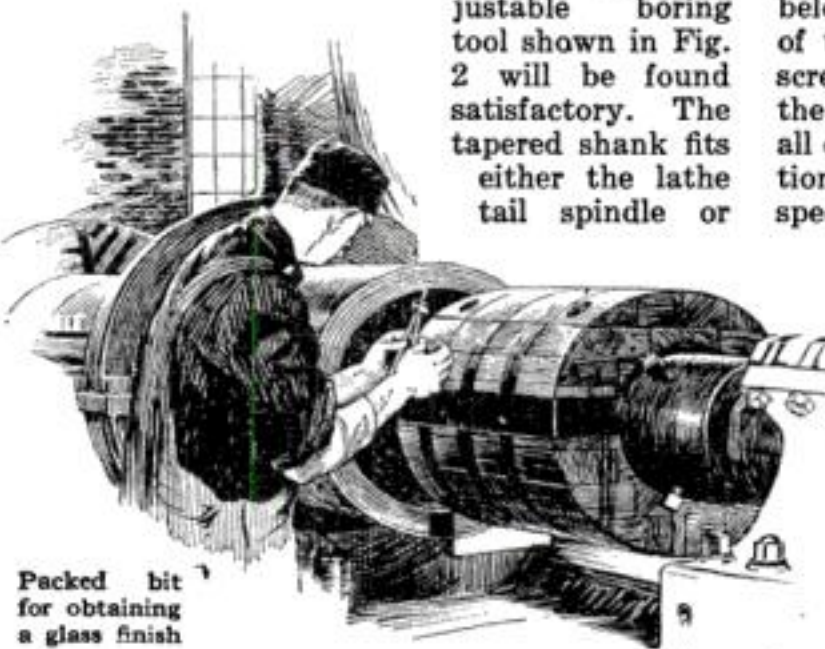
By George Arthur Luers

Mechanical and Automotive Engineer

and the steadying land below the cutting edge permit rapid cutting and still produce a smoothly machined surface. With tools of this shape there will be no excess chatter, and scale riding will be eliminated.

Instead of holding the tool rigidly in a toolpost, it may be necessary to have it so that it can be easily adjusted. For this

purpose the adjustable boring tool shown in Fig. 2 will be found satisfactory. The tapered shank fits either the lathe tail spindle or



Packed bit for obtaining a glass finish

the spindle of a vertical or horizontal boring machine. A single tool is fastened in the swivel by means of setscrews, and two adjusting screws permit adjustment of the cutting edge within a limited range. This type serves as a good all-purpose tool and the method of support provides the requisite steadiness to prevent chatter.

Using a Double-Edged Cutter

Where holes are deep, it is best not to attempt any boring with a single tool in a long boring bar since excess chatter is sure to result. For this purpose, a double-edged cutter will be found more satisfactory. Figure 3 shows a simple type. The tools should be set at equal distances from the center of the bar in order that the opposite cuts will have equal resistances. In this way great smoothness can be obtained.

While the long bar usually is used in a drilled hole, it will give good results even in a pipe having hard scale. Since the cutting edges are balanced, there will be no tendency to ride the scale. For this reason the edges can be ground to the usual taper of a drilling bit. The tool may be made of one or more pieces, but it must be possible to move out the tool as wear occurs. The wedge method of holding the tool in a rectangular slot is both simple and dependable, for it holds the tool firmly and allows for easy adjustment and removal of the tool for grinding.

Having decided upon either a single- or double-edged cutter, the mechanic's next consideration should be the holder. Figure 4 shows four methods in addition to the wedge method just mentioned that are considered satisfactory in making boring-tool holders.

Where additional support is needed, the upper two holders can be used to advantage. Here the tool is away from the end of the bar and the end can bear in a jig or bushing guide. The screw method shown below is applicable to cutters at the end of the boring bar, while the wedge and screw conjointly are used when finishing the extreme end of a bored recess. While all of these methods are correct, the selection of any one of them depends upon the special job that is to be done.

In all holding methods the wedges should have very slight tapers and the screws should be sufficiently large so that there will be no loosening or shifting under the cutting strain. Just a slight shift may produce an ineradicable gouge.

One of the hardest problems of the mechanic is the construction of a suitable tool for recess boring. To be successful, it must be made so that the tool can be expanded and also contracted for withdrawal.

Wedges will serve to open the tool, but they will not facilitate the closing, with the result that the tool protrudes as it is withdrawn and a gouge is made in the work.

Figure 5 shows a tool that has worked satisfactorily in recess boring. A central (Continued on page 108)

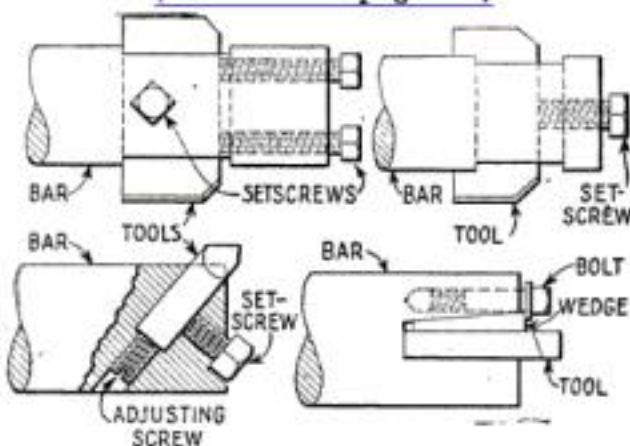


Fig. 4. Four methods of holding tools in boring bars, each having special advantages

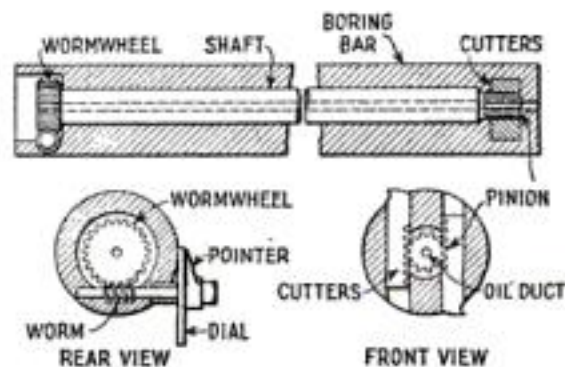


Fig. 5. One of the most successful types of adjustable boring bars for recessed work

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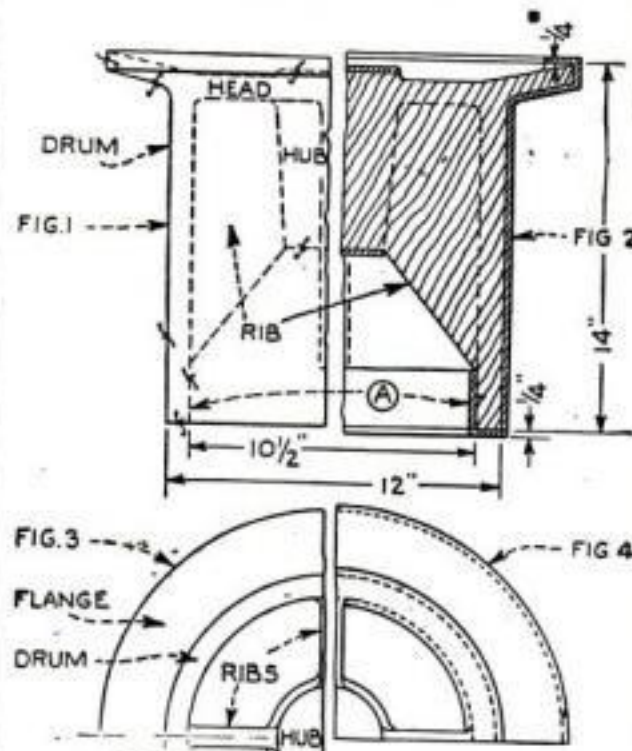
Simplifying a Rush Job in the Pattern Shop

By M. E. Duggan

What makes a mechanic successful? That really is the subject of this article by Mr. Duggan, who speaks with the authority of a man 44 years a mechanic and perhaps the best known foreman pattern-maker in the United States. In his story of a draftsman's thoughtlessness, a pattern-maker's indifference, and a foundryman's quick wit, he shows that common sense and cooperation are essential in solving the many puzzling problems that confront every mechanic.

A MECHANIC who knows his own little job will probably keep it. The man who knows how to do his job so that it will fit in well with the next man's, is the one who gets first consideration when there is a vacant foremanship. It is fatal for any mechanic to allow his own highly specialized work to absorb his interest to such an extent that he does not know what the previous man has done and what the next man is going to do.

Recently a striking and, to my mind, most interesting example of this came to my attention. A cast-iron drum had broken and the best promise that the manufacturer of the machine could offer



The finished surface at A made the pattern of this drum a puzzling problem

for a new part was delivery in about 12 days. So the mechanical department decided to do the job in the company's own shops.

The broken casting was taken into the drafting room for a drawing to be made. With great pains, a draftsman laid out the drawing, marking all surfaces to be finished as in the original. He completed his own little job to his own satisfaction and apparently it was correct in every detail. What he did not realize was that by a single *f* or finish mark on the drawing he had given the pattern-maker a job that would tax his ingenuity to the utmost.

The original casting (Figs. 1, 2, 3, and 4) had a finished interior surface (indicated at A) extending 4 in. up from the base, and this "finish" came mighty near finishing the pattern-maker. And there was no good reason for introducing this finish, as no other part fitted into it. The

(Continued on page 90)

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Please send me full particulars about the New "XC" Corona. No obligation on my part. Also address of nearest store.

Name

Address

Occupation

Simplifying a Rush Job

(Continued from page 88)

original manufacturer naturally wished the exposed end of the drum casting to revolve true, and the draftsman had unthinkingly provided for the same finish, overlooking the fact that now the great thing was to get the drum replaced and the machine in operation again.

How often a few strokes of a pencil by an unobservant draftsman either can simplify or complicate the work of pattern-maker, core-maker, molder, and machinist. In order to simplify work, the draftsman must know general pattern-making, foundry and machine-shop practice; otherwise time, labor, and material will surely be wasted.

The blueprint was then sent to the pattern-maker. He realized immediately that he would have a ring $\frac{1}{4}$ in. thick on the interior of the drum, which, if made fast to the drum, would project into the sand and lock the pattern firmly

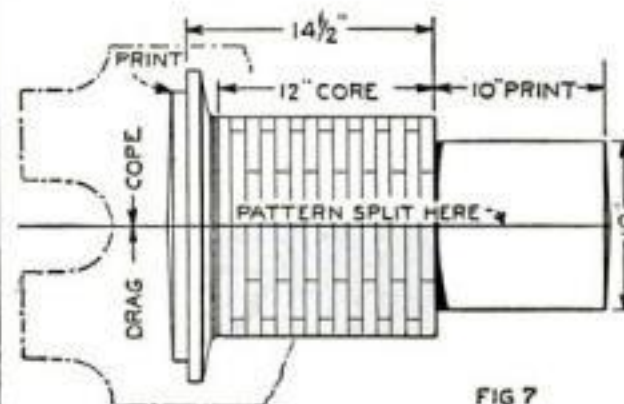


FIG 7

The pattern built in segmental courses at a cost of much unnecessary labor

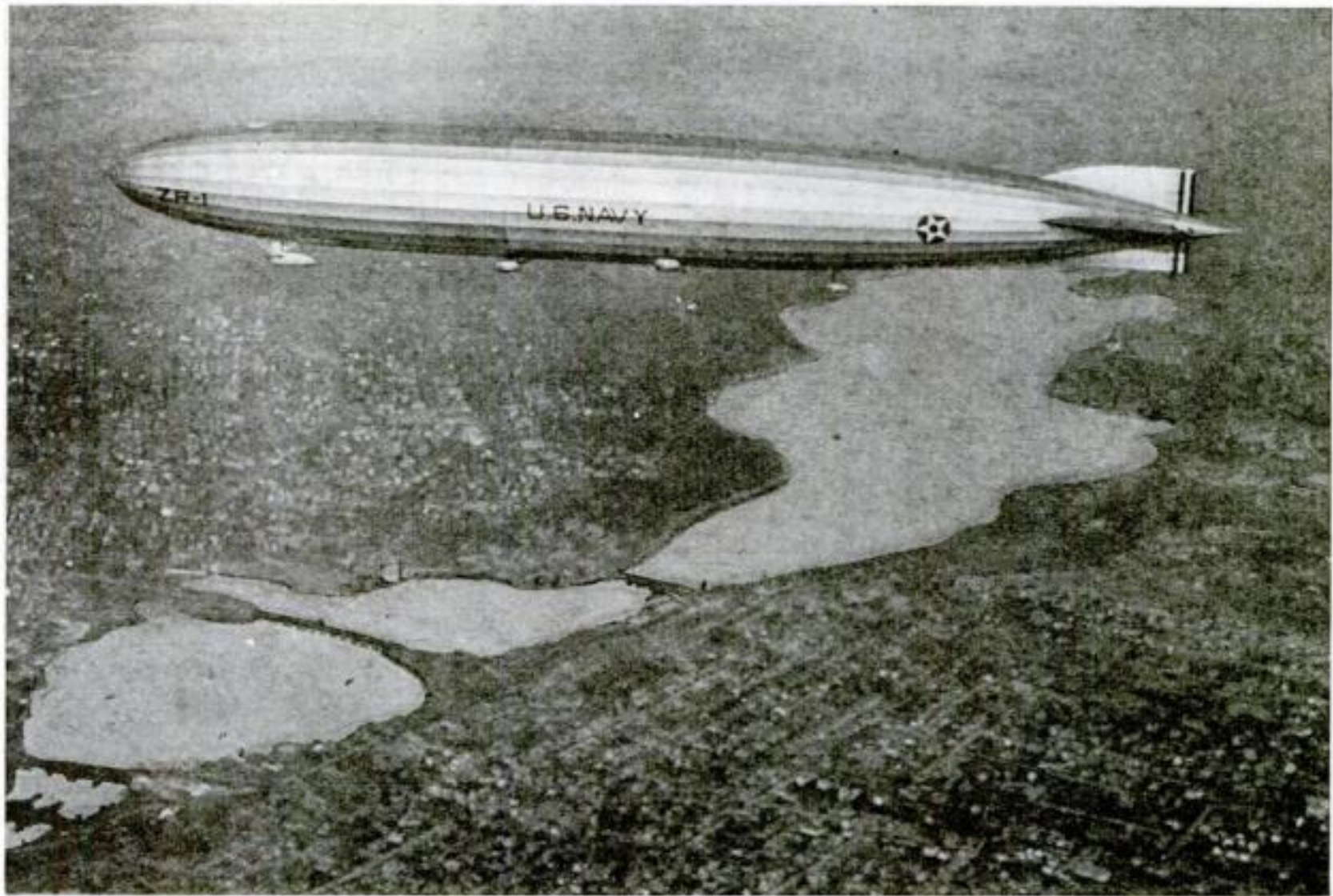
in the mold. It was too late to suggest changes in the design, for the work was wanted in a hurry. Moreover, he had learned that his job was making patterns and not telling the drafting department what to do.

After considerable study, he decided to make the ring in segments, loosely pinned to the drum pattern. The core-maker could then draw out the main part of the pattern and hook on to these segments and pull them out. The pattern was built in this way and sent to the foundry.

The core-maker shook his head when he saw the task laid out for him. In his estimation the pattern-maker should have known better than to have made the pattern in this way. It was contrary to the best molding practice. Besides, how were these little segments to be fished out of such a narrow cavity without damaging the side walls of the mold? And how were the walls to be patched if they should become torn up? He recognized it as the style of pattern-making known among foundrymen as "passing the buck."

The pattern-maker, not altogether certain whether he had done his job correctly, was curious about this particular casting and later on inquired about it. He was shown the finished product—a fine casting with the bugbear ring nicely in place within. Evidently he had made a good guess, and he patted himself on the back. While he did not know much about foundry practice, he had prepared a difficult pattern that WORKED!

(Continued on page 92)



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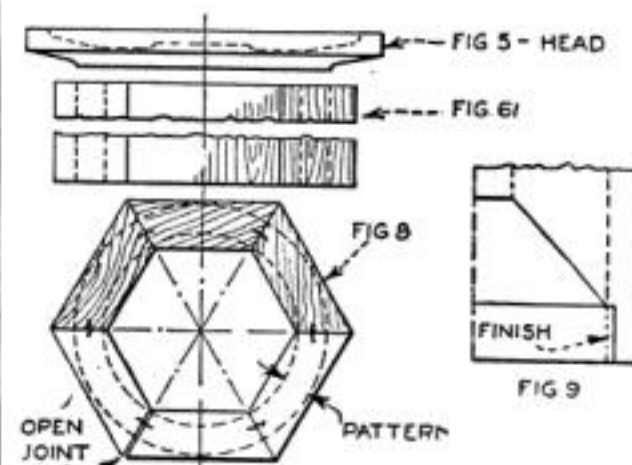
Address

Simplifying a Rush Job

(Continued from page 90)

But did it? Certainly not at all as the pattern-maker intended. As a matter of fact, the molder did not go fishing around for the loose segments. He placed the pattern on a bottom board, flange down. With a drag flask on the board, he shoveled molding sand in up to the top of the pattern. He next removed the dowel pins holding the segments, which were on top, and extracted the loose pieces from the mold. He placed slab cores, taken from the stock core shelves, over the circular cavity and continued filling in the sand.

The drag flask finished, the mold was rolled over and was then ready for the cope. The cope was made and lifted off, and the pattern was drawn out of the mold. There was nothing to prevent this because the segments were out of the way. The mold, drag and cope, was gated, mended in the usual manner, the cope set, and the mold closed. This was



The pattern as designed to give utmost economy both in pattern shop and foundry

practical molding practice, although the pattern-maker had not been aware of it.

It is thus seen that even though the draftsman may complicate a design and the pattern-maker may fall in line with him by guessing at molding methods, the molder sometimes can help himself by using the pattern in a way the pattern-maker had not intended. One of the greatest drawbacks for the apprentice pattern-maker in the acquisition of practical knowledge is the "distance" between the pattern shop and the foundry.

In Fig. 7 (page 90) the pattern is shown built up in segmental courses, core print at the flange end, and balance print at the opposite end. The dish in the flange as well as in the interior of the drum is molded in dry core sand. For these core sections, core boxes must be made. This is a costly pattern and is built in a way contrary to the best practical methods, but it is a method often followed by the pattern-maker who is not thoroughly posted.

Suppose we simplify the whole job, starting with the draftsman. Let it be understood that the casting is wanted in a hurry and consequently refinements of design are not to be considered. The one thing necessary is to get the casting made and the machine started.

Make the bore 10 in. in diameter instead of 10½. This will provide for finishing without those annoying segment pieces. The extra metal will in no way

(Continued on page 94)



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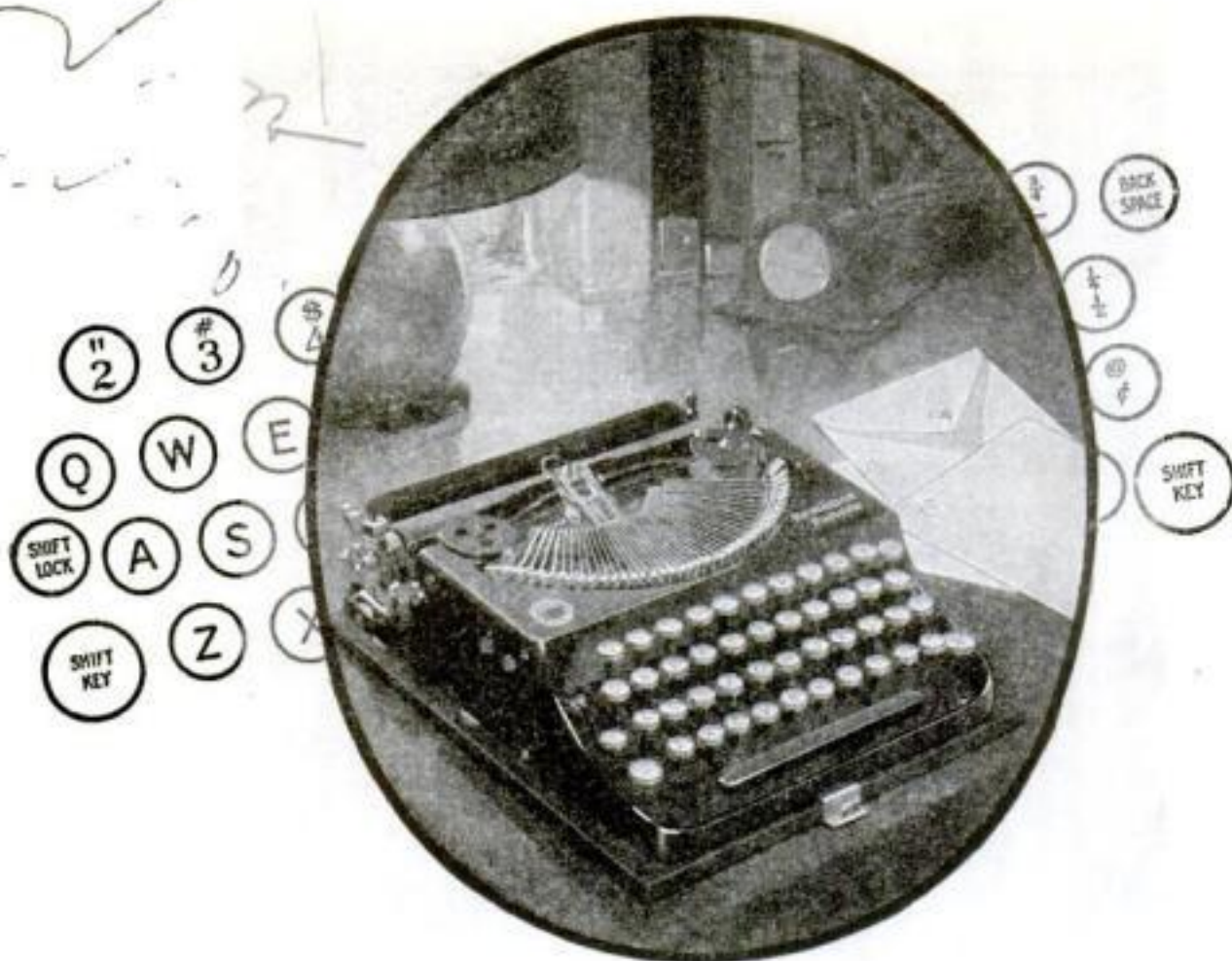
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Simplifying a Rush Job

(Continued from page 92)

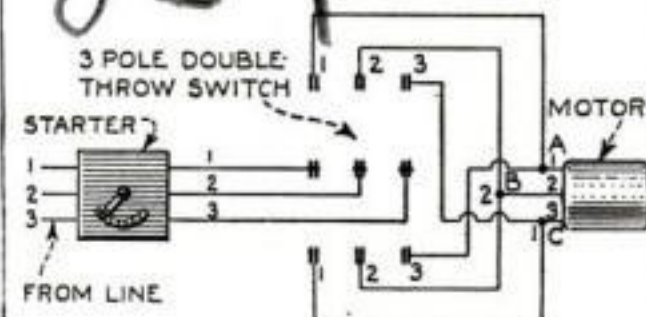
interfere with the purpose of the casting. On the contrary, it will give added strength to the drum.

In place of a built-up pattern in segmental courses, which involves increased labor, material, and time, turn the flange-head out of a single board (Fig. 5). Glue together six staves as shown in Figs. 6 and 8, leaving one open joint through which a bandsaw can be passed. Hold this together with a pinch dog and describe two circles to mark the outer and interior surfaces of the drum. Insert a bandsaw through the opening left for it and cut along the inside circle, making a slight bevel. Then repeat the operation on the outside.

If the job has been done well, it should be necessary to add only a sandpaper finish. Next, fasten the head to the drum and coat the whole with black varnish. By passing a lighted alcohol lamp over the surface, the alcohol can be burned away, leaving a hard and dry varnished surface. In this way it becomes unnecessary to wait three or four hours for the varnish to dry. Sandpaper the pattern and it is ready for the foundry.

Reversing an Electric Motor

THERE are times when the rotation of an electric motor must be reversed. With direct current it is necessary only to interchange the line connections of either the armature or field. If both are inter-



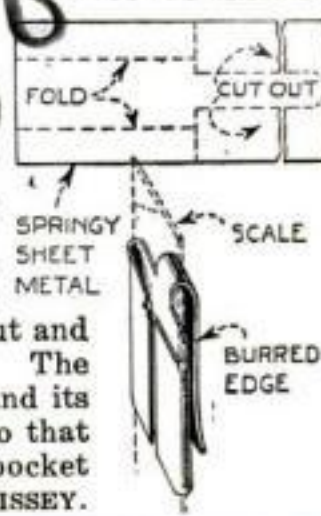
Wiring diagram, showing use of three-pole, double-throw switch to change motor's rotation

changed, the motor will continue to run in the same direction.

With alternating current, interchange any two of the three wires leading from the starting box to the three-phase motor. A convenient way of doing this with a three-pole, double-throw switch is shown in the accompanying diagram. It will be noticed that while the line marked 2 remains the same, the switch provides means for interchanging lines 1 and 3.—JAMES F. HOBART, Dunedin, Fla.

Holder Prevents Loss of Scale

A MECHANIC can make a clip for his steel scale that will hold it in the same way as a clip holds a pencil. A piece of springy sheet metal about 4 in. long and 3 in. wide is cut and bent as shown. The tongue is curved and its edges are burred so that it will grip the pocket firmly.—E.J. MORRISSEY.





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This handy set of saws includes 12-inch keyhole blade, 14-inch compass blade and 18-inch special nail-cutting blade, all interchangeable in the adjustable handle.

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Atkins No. 10 "Easy Grip" Hack Saw Frame shown in illustration above. Frame is adjustable to use 8 to 12 inch blades.

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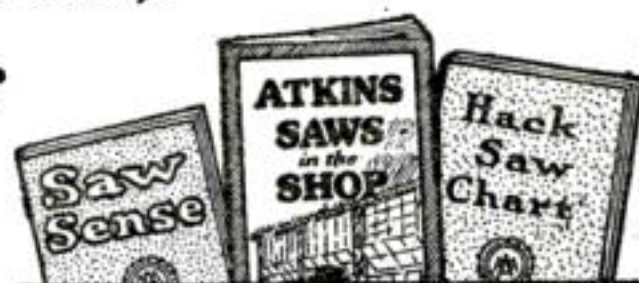
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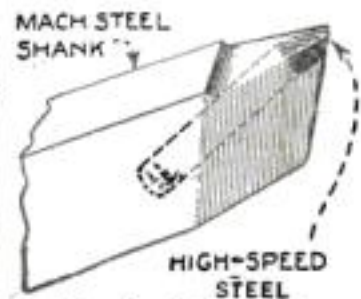


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High Speed Toolbits Retained in Holders by Shrinkage

Shank By W. Burr Bennett

MACHINISTS generally are familiar with the use of high-speed tools of the usual 18-4-1 mixture (tungsten, vanadium, and chromium). These tools are used as a solid forged tool, are welded to a machine steel shank or held in a shank with a setscrew. The welded bit is generally conceded to be next best to a solid tool—as, in addition to its economy value, it has heat conductivity and is more rigid.



The shank is shrunk over the toolbit

However, the majority of small shops and some large ones do not have the facilities for welding.

The accompanying illustration shows how an inserted toolbit can be made at a very

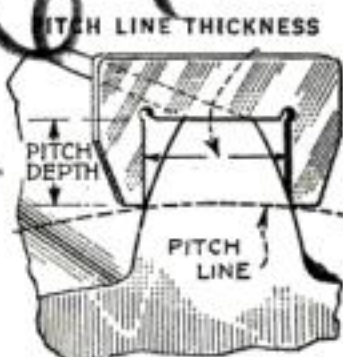
low cost with all the advantages of the welded tip and some others that the welded tip does not possess. The shank can be made of ordinary cold rolled or machine steel, but if stiffness is needed, it is better to make the shank of straight carbon tool steel.

Drill and ream a round hole for the high speed bit, making the hole about .010 in. smaller than the diameter of the bit. Purchase a treated bit of the size required and see that the surface is smooth. Put the shank in the fire and heat until it is a bright red. Clamp the tail end in a vise, drive home the bit, and quench in water.

The principle involved is that of driving home the bit in the semiplastic shank, and then insuring the fit by shrinking the shank around the bit by the water quench. The suggestion that the bit be purchased ready treated is made in view of the fact that relatively few small shops have the correct equipment for correctly treating high-speed steel.

Gear-Tooth Pitch Gage

A SIMPLE and accurate gear-tooth pitch gage can be made as illustrated out of sheet metal from 1/16 to 1/8 in. in thickness. When case-hardened, it will stand hard wear. Both the addendum or pitch depth and the thickness of tooth can be found in handbooks or calculated and should be carefully laid out on the sheet metal. The gage is applied to find the proper depth to sink the cutter.



How the gage is applied to a gear tooth

When the points of the gage just touch the tooth's flank face, the gage should rest squarely upon the tooth surface. This being true, the points are exactly on the pitch line or pitch point.

This gage may be used for either spur or bevel gears. In gaging bevel gears the gage should be applied at the extreme edge on the large end of the tooth.—H. W.

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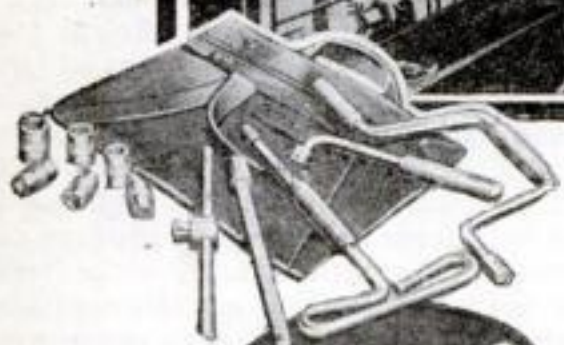
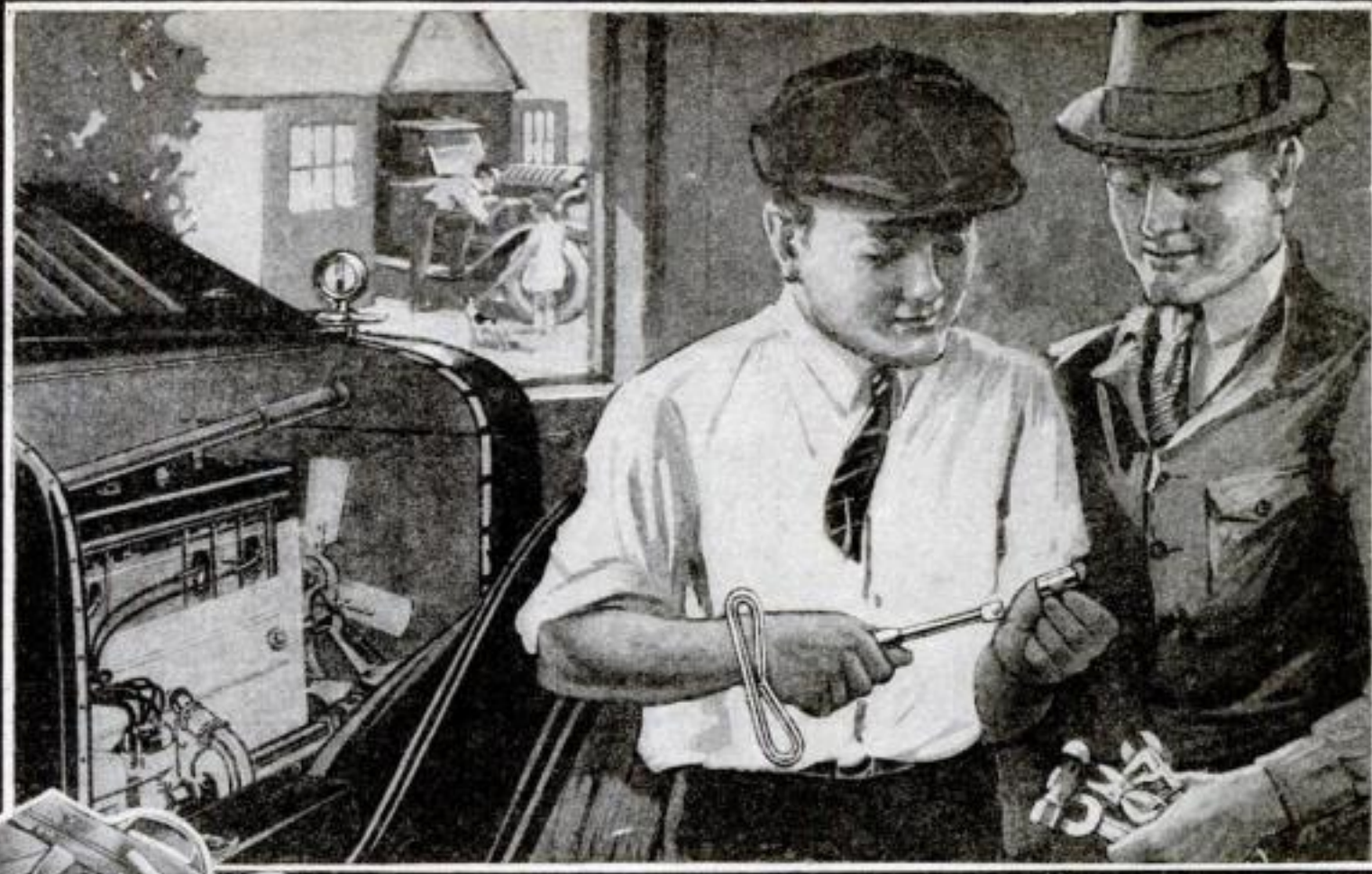
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The terrain of the telephone army is the whole United States, dotted with 14,000,000 instruments, all within range of the subscriber's telephone voice. Even in the remote places this army provides equipment and supplies. Its methods of operation are constantly being improved, that each user may talk to his friends with increased efficiency. Millions of money are spent in its permanent works. Yet its costs of operation are studiously held to the minimum, that the subscriber may continue to receive the cheapest as well as the best telephone service in the world.

The permanent objective of the Bell System army is to meet the telephone needs of the nation—a hopeless task were not its command unified, its equipment adequately maintained and its personnel trained in the latest developments of telephone art.



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Solid Forged Lathe Tool versus Toolbit and Holder

Among the interesting letters received from readers in response to the invitation for a general discussion of an article, "Getting the Most Out of Your Lathe Tools," in the January issue, are the following:

By E. O. Dygert,
Cle Elum, Wash.

Having been a reader of Mr. Romig's articles for some time, I took great interest in the one on "Getting the Most Out of Your Lathe Tools." As I have been in harness since before the day of high speed steel, I well know the value of a substantial forged tool.

Turning 14-in. crankshafts and tailshafts in marine work, Lloyd's specification for Shipping Board engines, we never attempted to use anything but forged tools. They stood up under the heavy cuts necessary on this work, and the aim was maximum production.

In lathe work the most efficient tool is found by taking the product of the tool travel over the surface of the work in feet by the weight of metal removed a minute, for one grinding of the tool. It will invariably be found that high speeds and light feeds are unable to produce the results of slower speeds and heavier feeds.

I can vouch for the correctness of Mr. Romig's belief from my own experience, as it accords with his at every angle of his discussion.

Give me a good substantial forged tool for roughing, let the other fellow select any other kind, and I can assure you that he will fall far behind in any production test.

By F. J. Wilhelm,
Cincinnati, Ohio

IN SPITE of the excellent arguments made by Mr. Romig in his article on lathe tools in the January POPULAR SCIENCE MONTHLY, my experience has been that the toolbit in most cases is a wonder for production.

For roughing heavy forgings such as are made in large steel mills (and the writer has had quite a little experience with such work), it is true that the forgings are rather large and overize because the blacksmiths work on tonnage, but it must be remembered that large forgings always go on large lathes. Large lathes take large toolbits and everything is in proportion, and it is no harder to use a large toolbit than a small one. So far as the amount of heat is concerned on large work, I have never seen a piece of really high grade steel burn up under the heaviest cut.

For finishing work, when the toolbit is properly ground for finishing and then rubbed with an oilstone and a little oil along the edge to remove the rag that the emery wheel has left, finishing work can be done very nicely and inexpensively.

So far as the shell-turning job referred to by Mr. Romig is concerned, the writer has designed special lathes, built them, and kept a battery of them running without any trouble with toolbit tooling. We ran on surface speed at 35 ft. a minute with a 3/32-in. feed, using one roughing and one finishing cut.



Neptunite

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WHEN the well-informed painter selects his varnish for work of especial importance, he chooses Neptunite. He has found that, in finishing a floor, Neptunite, with its heavy body and slow-setting quality, gives ample time for careful working. He knows that it levels perfectly, dries quickly to a hard surface, and makes a gleaming, lustrous floor that enhances the beauty of the natural wood grain, yet whose mirror-like surface reflects in subdued tones the color harmony of the room.

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snow. He knows that Neptunite never turns white. It doesn't even scratch white.

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For fifty years experienced painters, decorators, architects and home owners have recognized the high quality of Lowe Brothers "High Standard" Paint—rich colors that retain their newness for many years—protective ability against wear and weather—capacity for covering so that less paint is required for the job. You will find beauty, protection and real economy in the use of this paint.

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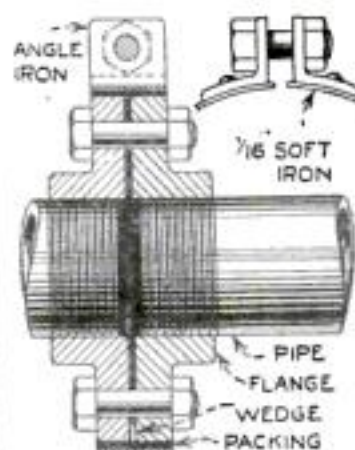
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Making

Blown-Out Gasket

IT SOMETIMES happens that the gasket between two flanges in a steam line will spring a leak at a time when it is impossible to stop work and make a proper repair to the joint. In one such emergency a temporary repair was made by driving a wedge of pine into the crack



How the blown gasket was fixed

after the steam had been shut off, and cutting it off flush. A piece of rubber steam packing was placed around the flange and held tightly in place with an iron band, resembling a brake band. The band was made of 1/16-in. soft iron with a length

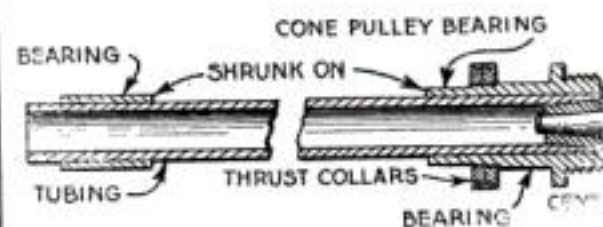
equal to the circumference of the flanges. The lugs for drawing it tight were of 1-in. angle iron, riveted 1/2 in. from the ends and brazed. Before placing the packing, the joint was covered with pipe joint cement.

The steam was turned on and the bolt in the band followed up a little at a time until it was solid. No leak has as yet appeared.—A. S. JAMIESON, Springfield, Mass.

Fitting an Old Lathe with a New Hollow Spindle

AN OLD lathe with a solid spindle may be improved greatly by fitting it with a hollow spindle. Since small shops are not usually equipped with facilities for deep drilling, the spindle cannot be made easily from a forging. It is possible, however, to construct the spindle from a piece of seamless steel tubing of a length and diameter to conform to the lathe.

The tubing is first centered and turned down for a distance of about 12 in. to



The new spindle is made of seamless steel tubing with bearing pieces shrunk on

receive the bearing pieces. The pieces for the front and back bearings (mild machine steel) are then rough turned and bored, allowing for shrinkage. After being centered, the assembled spindle is finished and the thread for the thrust collar is cut. The last operation is to cut the thread on the spindle nose and bore the taper hole.

The spindle is improved still more by fitting a set of spring draw-in chucks. In redesigning a lathe spindle the bearing should be enlarged as much as the stock design will permit.—H. L. WHIT

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(P. S. M. 3-24)

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Ball thrust bearing. Cut gears.

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Look for this display box on the counter or in the case in your hardware store. It holds big value for you if you want a hand drill.



Stretching a Fifty-dollar Bill Into a \$5,000 Business

By C. J. GEBHARDT

THE SECOND of last March was my birthday and made three years I'd hung on to my job at the Elite shop where I was sort of a Handy Andy around cars. I'd been working nine years in all—and had just \$50 to my name to show for it.

Last December—nine months later—my Christmas present was receipts for the last nickel to pay on a \$5,000 business of my own and I still had \$508 to my credit in the bank.

What woke me up was a letter I got the night I was planning a celebration of my birthday with the boys. I staid home, and the gang thought I must be sick. I was sick—of the rut I was in. I wanted to get out of it, and this letter from a pal who had gone to Chicago showed me a chance. He told me how he was now a partner in an automotive electrical service station and had made good with a bang. Here



in Harrisburg he hadn't even been in the automobile game. So I was plenty interested in what that letter had to say! Here's the part that woke me up:

"It doesn't take a detective to find a broken spring or a loose clutch," the letter ran, "nor a master mechanic to fix such things. It's the fellow who knows that the big money in the automobile line is in the electrical work—and knows how to handle it—who gets on." Then came the eye-opener. I learned that a u t o m o b i l e l e c t r i c i t y o n l y s e e m s c o m p l i c a t e d a n d i s r e a l l y q u i t e s i m p l e. Everything electrical on any car, and everything that can happen to it, falls in one or the other of only three classes. Certain tests tell which of these three divisions all electrical trouble is in, and once you have that information you can put your finger on what's wrong. I found how I could master automotive electricity in fifty days, and I did. You can do it too, if you'll take five minutes to read this explanation and let it sink in:

This 5-Minute Test will tell if your mind runs to mastery of automotive electricity. Suppose you had to know which way the current is going in coil below:



1. A compass is placed at end of coil. The needle turns and points.



2. If the south pole is toward coil, grasp coil with right hand—thumb toward compass. The fingers point the way current is moving through coil.



3. If north end of needle turns toward coil, grasp coil so thumb points away from compass. Fingers point the way current is going—in opposite direction from No. 2.

IF ABOVE IS CLEAR TO YOU then you can learn automotive electrical principles! It is all just as simple and sensible as this. You are wasting your time by not knowing.

ally—and you can find what is wrong, fix it, and have the money in your pocket while the fellow who has to guess is wondering what to try next! All that's needed then is a little practice with the instruments that detect and measure electric energy, and you can just about pick your own employer or else do as I did and strike out for yourself.

I put in exactly fifty days getting the principles of electricity down pat and getting confidence doing practical jobs on every sort of motor and generator. I never could have dug it out of books. I doubt if I ever would have got it from watching others. My

first move after I had taken this shortcut to really knowing electricity and what it was all about was to try myself out here in town. I took an electric repair job in one of the biggest garages in town, at \$35 a week.

The first morning, in rolled a bus wired like a Chinese puzzle, with a generator like nothing I'd ever come across; and the owner had a whole list of things that were wrong. I admit that I would have slipped out of the shop if I hadn't hung my coat in the boss' office. But I figured that electricity is electricity, and if the things I'd learned weren't equal to any occasion I was going to find it out there and then. So I put all the switches the way I knew they ought to go for my first test, took the readings I'd learned to make for classifying the trouble whatever it was—and it worked!

I had the difficulty nailed inside of half an hour, and by noon I had that car all set. When the customer told me he had had his car to two other places that had been stumped on that job, it made me feel pretty good.

I put in about a month when I got raised to \$50 a week without asking for it.

Two months later, the delivery superintendent of the store that sent all its cars to our shop put it in my head to start up for myself. He got me the use of an old barn of the company's and I soon had enough other work to keep me and two others busy. In almost less time than you'd believe it could count up I had enough cash to pay down a thousand dollars toward buying the building and we put in a new floor and some benches and other conveniences. I guess I must have nearly a thousand dollars worth of tools and instruments, now, too, although I didn't have many nor need so many at the beginning. As I have said, the business is all mine now, and all paid for, and I drew \$75 a week for myself from the day I opened up shop.

I haven't told all this to brag about myself or how smart I am, but in hopes it would be a help to someone who may be like I was hardly over six months ago—dubbing along in the dirt and grease, and kidding myself I was in the automobile business. Also, I want to give the credit where the most of it is due—the institution that planted principles of electricity in my head in such a way I could use them and turn them into cash. It was the Ambu Engineering Institute in Chicago that gave me my start. So far as I know, it is the only place in the country where automotive electricity has been reduced to such simple terms that any fellow who can't master it is simple himself. It is so easy that even the little book they send you free will prove the whole proposition to you in half an hour. And I am glad that I sent for it!

C. J. Buckwalter, Pres.
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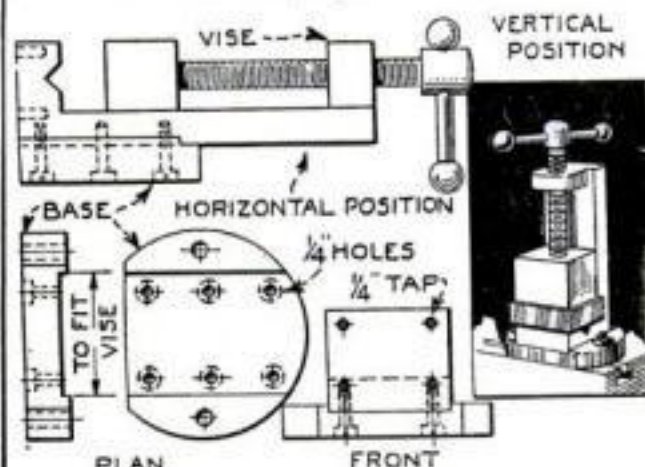
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Base Adapts Small Tool Vise for Machine Use

WHEN fitted with a base, a small machine vise of the ordinary variety designed for holding small parts for drilling can be used to good advantage on hand millers, grinders, and other machine tools.

To make such a base, turn a disk of cast iron to suitable diameter, face it on one side and cut a groove in a shaper through



The vise is fastened either horizontally or vertically to a special cast-iron base

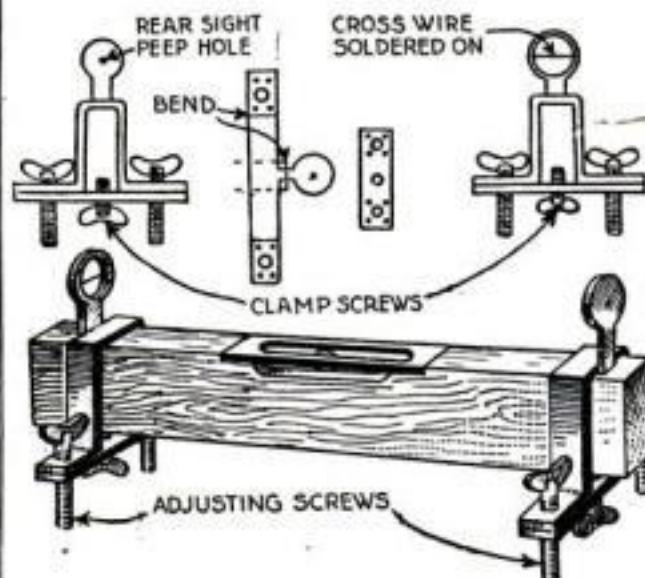
the center to the depth of $\frac{1}{8}$ in. and exactly as wide as the vise. The base is then drilled for two hold-down bolts, either $\frac{3}{8}$ or $\frac{1}{2}$ in. Small holes are also drilled and counterbored as shown for the screws that fasten the vise to the base, either in a horizontal or vertical position.

Facing off the base so that it will be flush with the top of the vise, when the vise is in the vertical position, allows the work to be clamped close to the forward edge of the worktable. That is often a great advantage for end milling with short cutters.—V. R.

Sights Adapt Carpenter's Level for Grading and Fencing

A BUILDER'S level or a surveyor's transit is not always available when fences, walls, farming, or grading operations are to be laid out. An ordinary carpenter's level may be made an effective substitute in all sorts of such lining-up jobs.

Two sights to fit the level are purchased or made, one with a peephole of about



How the front and rear sights are attached to a wooden or metal level

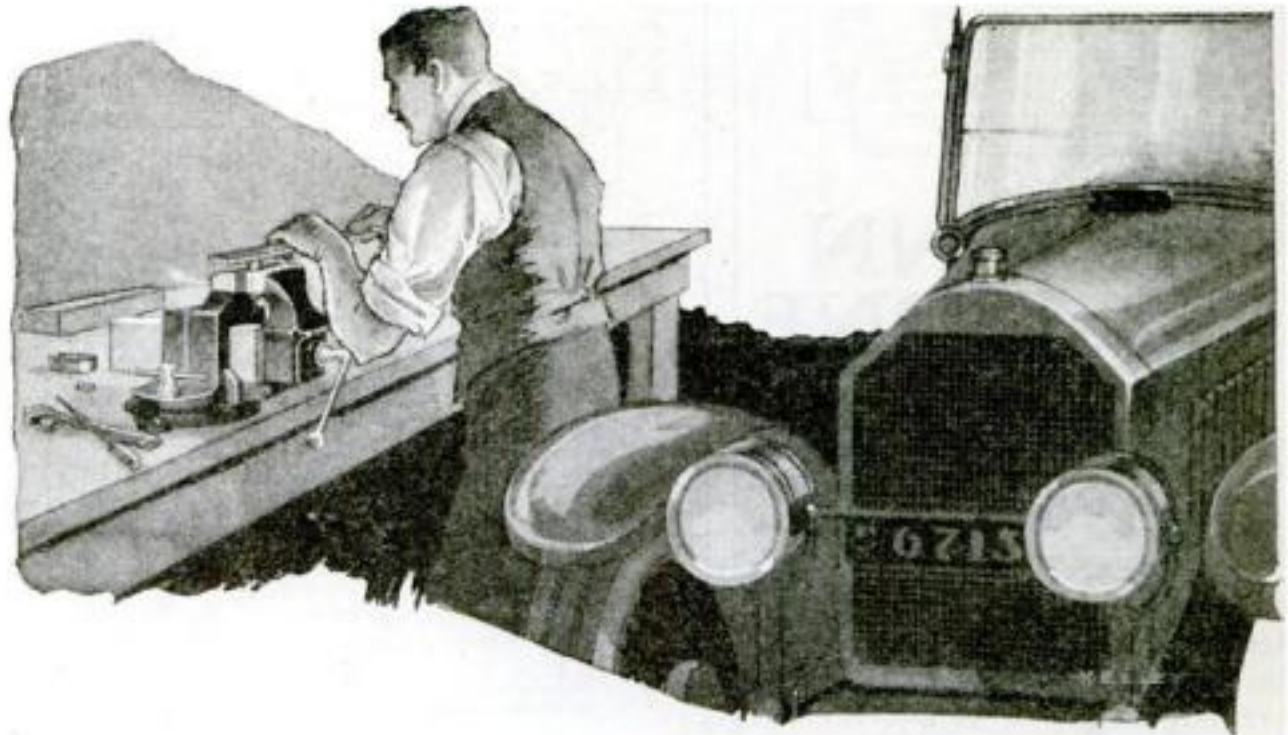
$\frac{1}{16}$ in. diameter and the other with a larger hole that has a horizontal length of thin wire soldered across it. The two side screws on each sight are used to level up the instrument upon any convenient and relatively flat surface.—G. L.

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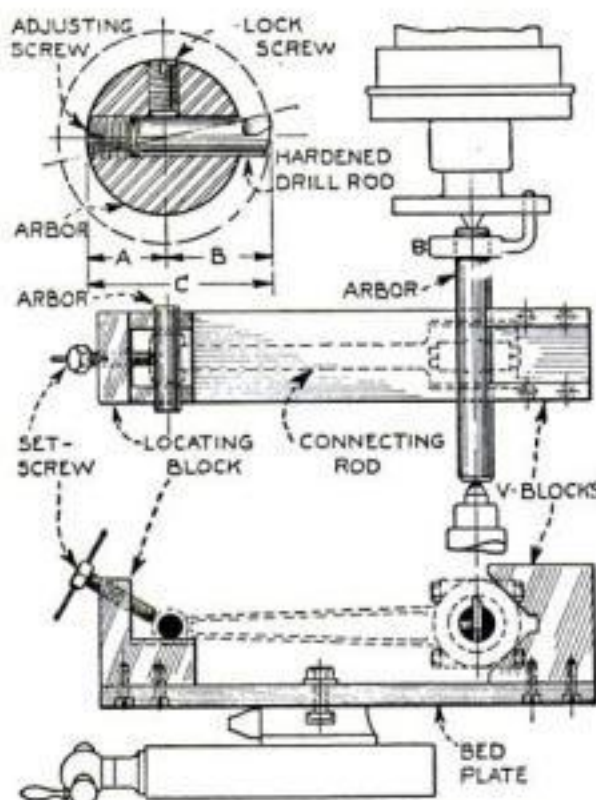
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Fixture Simplifies Reaming of Rebabbitted Connecting Rods

Rebabbitted Connecting Rods
Auto - Connecting Rods
AUTOMOTIVE repairmen more or less often are confronted with the job of rebabbitting and reaming or boring out the crankshaft end of connecting rods. While fixtures for this work are on the market, small shops can do the job well with a simple device that can be attached to the cross-slide of a lathe.

Two V-blocks are fastened to one end of a bedplate and a locating block, with sides accurately parallel is attached as shown to the other end. A setscrew in the block serves to force the wristpin end of a connecting rod down between its parallel sides as well as pressing the crankshaft



Top and side views of the connecting-rod fixture and details of boring rod and tool

end into the V-blocks. A small arbor in the wristpin hole bears on the parallels and keeps the axis of the hole to be reamed horizontal, while the arbor with the cutting tool, which is carried between the lathe centers, keeps the axis correct in the vertical plane.

Referring to the accompanying cross section of the arbor, the distance *B* represents the radius of the finished hole and *A* is the radius of the arbor. If the tool is set accurately by means of micrometers, and has a broad, smooth edge, there will be no necessity for scraping after the finishing cut has been taken.

In babbitting such a job, only metal with a tin and not a cheap lead base should be used. While an 80 per cent tin alloy will require a very hot ladle and rod to pour, the results will well repay the effort. Pour the babbitt on an arbor about $\frac{1}{8}$ in. smaller in diameter than the finished bore. After it has cooled, take the cap from the rod and carefully peen each half, making sure not to peen too deeply. Then bolt the cap to the rod, and the job is ready for this fixture.

AN EXCELLENT leather cement can be made of equal parts of good hide glue and American isinglass, softened in water for 10 hours and then boiled with pure tannin until the whole mass is sticky. The surface of the joint should be roughened and the cement applied hot.

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Now—a rowboat motor that leaves nothing to be desired—that will take you anywhere and back, regardless of weeds, of shallows, of hidden obstructions—of anything but an empty gasoline tank. It has twin cylinders, eliminating vibration. It is light in weight and easily carried. It is of the direct drive type, has no bevel gears—wastes no power. The propeller extends straight out from the stern of the boat and seeks its own level in the water. Merely touching a hidden obstruction causes it to rise and pass over. Other so-called "tilting" motors require a blow of 60 to 70 pounds to cause them to tilt. Such a blow ruins a propeller. The



is the higher and more refined development of the direct drive principle which has proven its correctness over a period of years. It is not new and untried. This principle, combined with twin cylinders, light weight, compactness and

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provides a motor unsurpassed by any on the market. It is the only rowboat motor equipped with the Bosch Rocking Type Magneto which was designed by the combined Caille and Bosch engineering staffs. It delivers a uniform hot spark at any speed. Should you ever require ignition service you can secure it from any of the 2,100 Bosch Service Stations throughout America. Flywheel type magnetos can only be serviced from the factory. This means long delays and sacrifice of the motor's use—often when you want it most.

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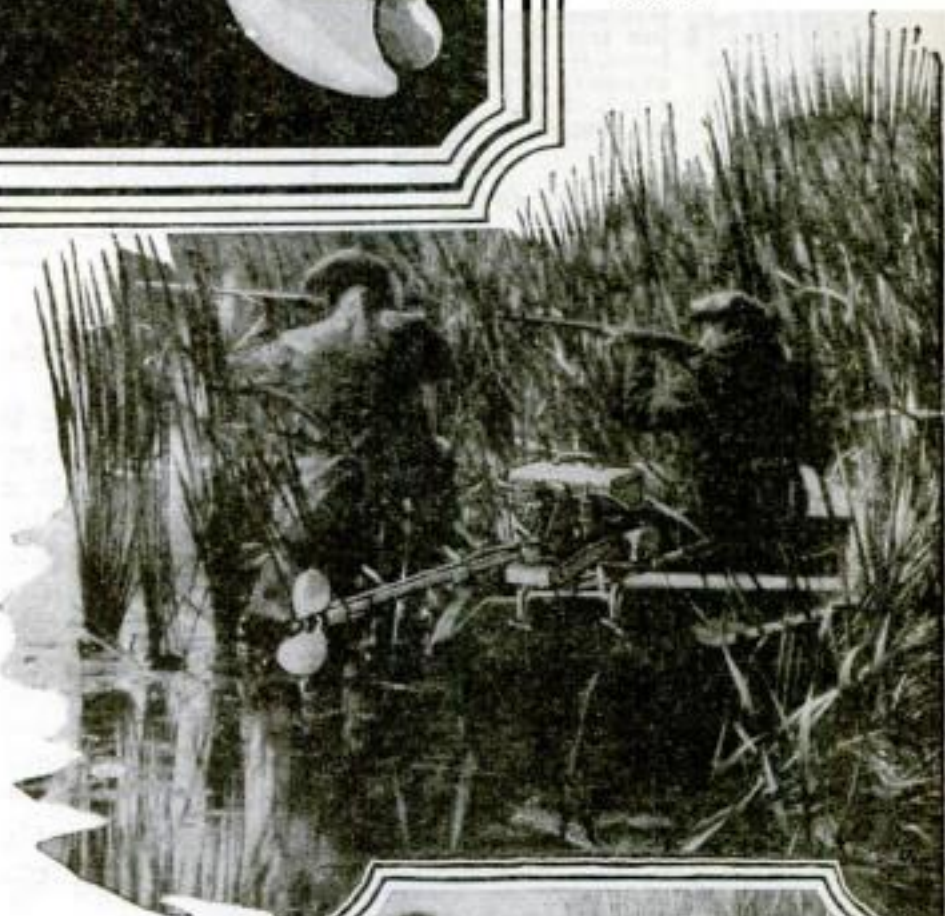
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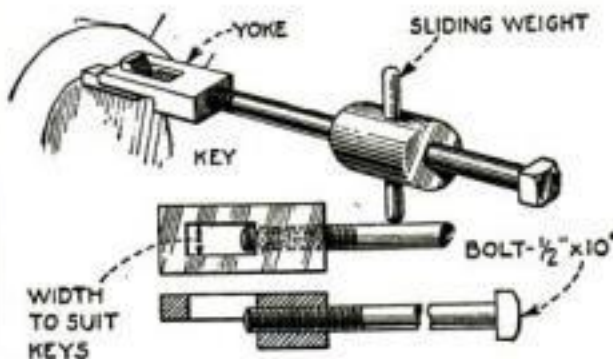
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Stubborn Keys Drawn by Means of Hammer-Like Puller

IT IS often difficult to remove machine keys without damaging the heads, for the reason that they have been driven home hard with a hammer. A simple form of key puller that will accomplish this is made as illustrated.

A block of machinery steel is shaped as shown, then squared to fit loosely over



This type of machine-key puller will not damage the heads of firmly fixed keys

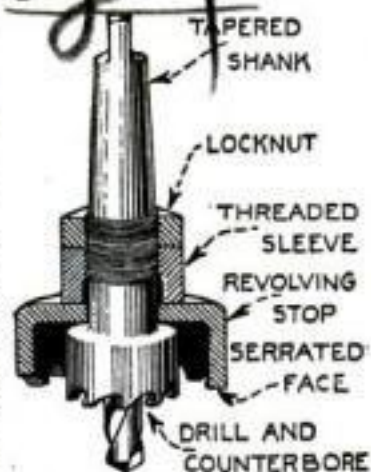
the head of the key. The rear of the block is left thick and heavy and is tapped for a $\frac{1}{2}$ -in. bolt about 10 in. long. A weight is made to slide freely over this bolt. This weight either can be knurled or have two handles fitted to it. The yoke member of the puller should be case-hardened to increase its strength.

When the weight is pulled back against the head of the bolt, a hammer action is produced that soon loosens the key.

Serrated Depth Stop for Drilling and Spot Facing

SPOT facing the surface of either plate or castings for both heads simultaneously with drilling the holes, can be done effectively with the tool illustrated. The loose revolving stop with a serrated face enables the drill-press operator to control the depth and still overcome scraping or side strain difficulties that would be caused by using an ordinary depth gage.

The drill and countersink is made as usual, while the stop arrangement is a sleeve fitted about the shank with adjustable threaded collars above it.



Used with combination drill and counterbore

FEATURES FOR APRIL

"INGENIOUS Work-Holding Fixtures," by F. J. Wilhelm, will appear in the Better Shop Methods Department next month.

W. Burr Bennett will describe a simple nut-tapping fixture; Frank N. Coakley will give details of a homemade valve grinder for the garage man; Donald A. Price will give a design for an eccentric foundry flask clamp; and George A. Luers will explain a new one-piece tool for refitting engine valves.

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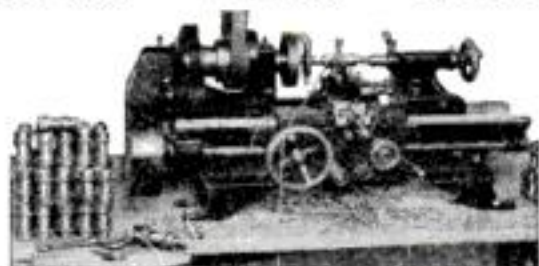
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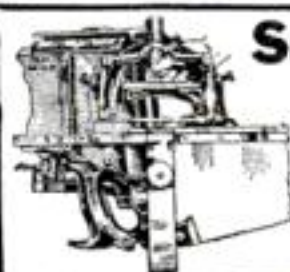


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Speedy and Accurate Boring

(Continued from page 86)

hole through the bar accommodates a continuous shaft. The shaft terminates at one end in a pinion; to the opposite end is fitted a wormwheel. Small racks are machined in the cutters (or made separately) so that these will mesh with the pinion. The wormwheel at the other end is turned by a worm fastened to a shaft extending crosswise of the bar. A dial is graduated to indicate the amount of movement of the tools when the wormshaft is turned. The final cut is made when the pointer is at some specific number on the dial.

This type of exterior adjustable bar has given more satisfactory service than any

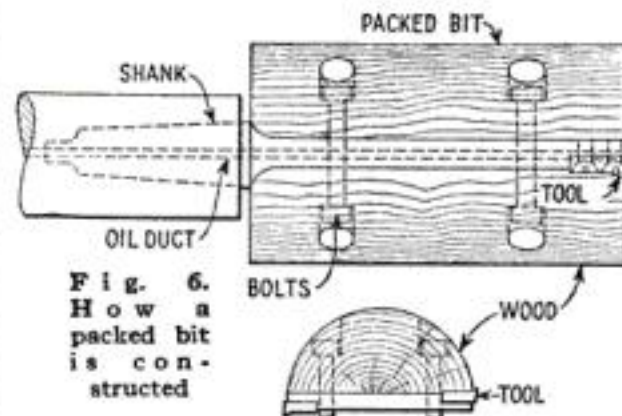


Fig. 6.
How a
packed bit
is con-
structed

of a hundred others that have been tried out in one large manufacturing plant, and its construction is applicable to practically every job of recess boring that a machinist is likely to encounter.

It may be well to bear in mind that makeshift tools can be a source of much lost time and effort. Such tools frequently are broken or turn off the boring bar. As a result, either the work is spoiled or the tool is jammed into the recess and many hours of labor are required in extracting the parts.

A glass-smooth finish is often required in the bore of steel tubes such as are used in pneumatic or hydraulic machinery and in guns and rifles. The tool used to obtain this is not generally familiar to machinists.

With a packed-bit boring tool the finishing cut can be made as free of tool marks and as smooth as though it had been finished with polishing materials. A detail sketch of the packed-bit tool is shown in Fig. 6. There must be a wood packing about the cutters; steel cannot be used. The cutter holder can be any

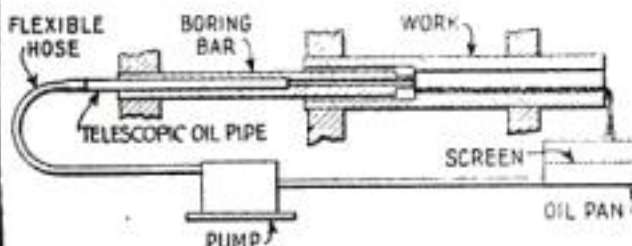


Fig. 7. Using a telescopic oil pipe and hollow bar for thorough lubrication

shape of steel plate slightly smaller in width than the bore of the cylinder. A shank or bar to fit the machine boring bar is provided, the cutter being a separate head for the purpose of removal, setting or sharpening the blades, and repacking.

The tools are usually screwed on and finished in the holder. The wood is either oak or hickory, although other hard wood will serve. These sections are bolted to

(Continued on page 110)

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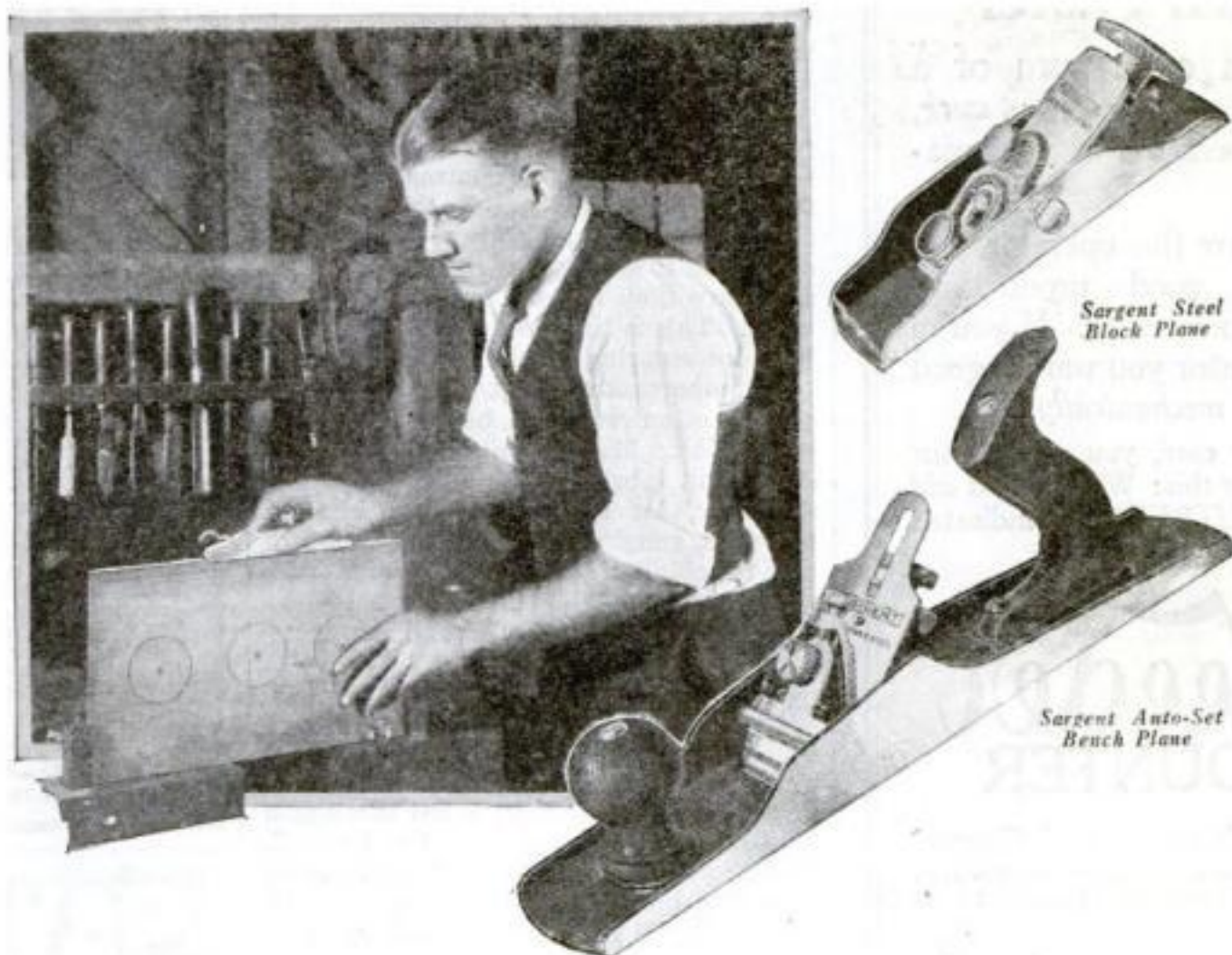
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R. H. FRAVEL, Patent Attorney
Formerly of the U. S. Patent Office Examining Corps.
Room 207, Stewart Bldg., Washington, D. C.



He'll have it planed *in a jiffy!*

IN THIS home workshop radio is king. In fact, a goodly number of big and little sets, comparable to expensive commercial types, have gone from this bench into neighboring homes. This young man has a reputation for good workmanship. He takes particular pride in his ability to choose and use good tools.

Once you have used the handy little Sargent Steel Block Plane, no other finishing plane will do. It is great for work in close quarters, for smoothing up panels, bureau drawers that have been sticking, and similar things. It is as true and clean cutting and as finely made as the larger Sargent Auto-Set Bench Plane shown above.

The Auto-Set, of course, should be in every workshop for use on the bigger jobs. It is light in weight and remarkably easy to adjust or sharpen. The chromium steel cutter may be removed, honed and replaced without changing the original adjustment. Yet it is so firmly held in place that it never chatters, even when cutting across the grain or over rough and knotty surfaces. You will find the Sargent Auto-Set Plane an aid to speed and accuracy.

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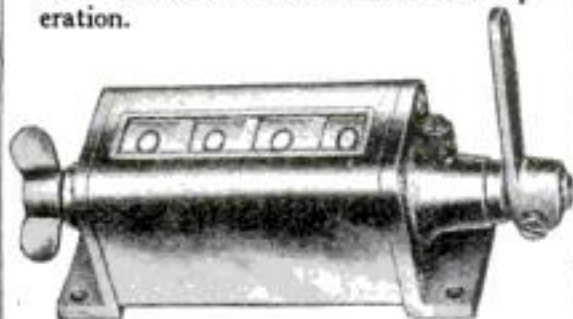
—when each turn of a shaft records a piece of *work*, or an operation of your machine.

If you are the operator, you want a good production-record, personally. If you're the inventor you want a good showing *mechanically*.

In either case, you gauge your actions by this: What does it *add* to the *OUTPUT*?—as indicated on the

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The Revolution Set-Back Counter below records the output of any machine where a shaft-revolution indicates an operation.



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The Hand Tally illustrated below is used for counting anything from number of people attending a ball game, to number of packages in an inventory. In the public place it counts *persons*; in the factory or store it counts *stock*; in the "open" it may count anything from cattle on a ranch, to poles on a telephone line! Registers one for each pressure of the thumb lever: counts up to 10,000, then repeats. Can be set back to zero from any figure by turning knob once round. Size, exclusive of finger ring, 2 inches greatest diameter. Price, \$5.00.



Write us about that counting problem of yours—it's probably answered in the 80-page Veeder booklet; copy free

The Veeder Mfg. Co.,
44 Sargeant St., Hartford, Conn.

Speedy and Accurate Boring

(Continued from page 108)

the holder and turned on the lathe, to a diameter of two or three hundredths of an inch larger than the bore to be finished.

As the tool enters the work, the hardwood packing on the head follows, supporting the tools from every side and preventing any possible chatter. A continuous flow of oil must precede the cutters so as to wash away all chips. A few chips are bound to get by, but these do no damage, since they become embedded in the wood. This is the most serviceable of all tools for securing a smooth bore.

An important element to be taken into consideration with all boring is proper lubrication. Machine oil or some equally good fluid lubricant should be used unsparingly, for it decreases the friction, prevents gouging caused by chips and avoids galling of the boring bar and other moving parts. Oil carries off the heat produced by the cutters as well as removing the chips.

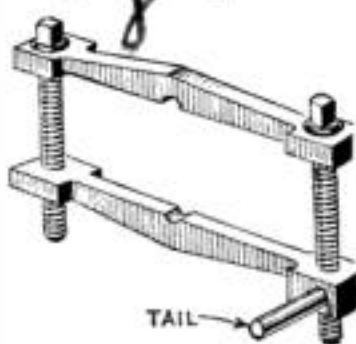
Feeding Oil to the Cutters

Methods for getting oil to the cutters vary. In some cases oil is fed through a hole running the length of the bar. A pump forces the oil into this tube through a flexible hose; the oil runs out at the other end and is caught in a screened pan and brought back to the pump for recirculation. Where a pump is not available, an elevated reservoir can be used to feed the oil. All oil should be screened before being returned to the reservoir. Figure 7 shows a method giving continuous oil supply.

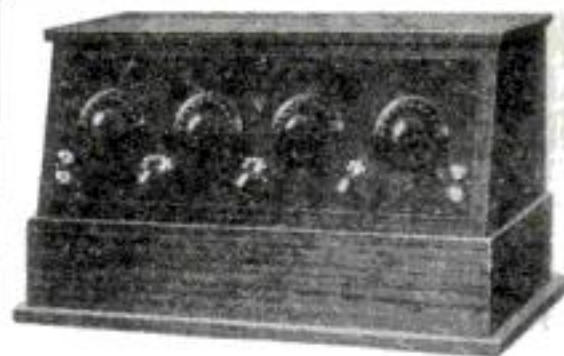
Where entrance is to be had at the end of the work opposite the bar, a small copper or brass pipe can be inserted through which oil can be run from an elevated reservoir. In some instances this method cannot be employed. The open end is then blocked with a disk fitted with a central hole for housing a loose extension from the bottom of the oil container. The oil is thus blocked against running out at the end of the tube and flows back past the cutters and out at the boring bar end of the work.

If you use the proper tools, have these in the best condition, lubricate all work well and adhere to approved practices, you will not be likely to suffer the experience of Joseph Dyson.

Joseph Dyson
Universal Lathe Dog
THIS lathe dog will grip work with a large range of diameters. Two pieces of 1/2-in. square steel about 3 in. long are shaped as in the figure, with the center left wider to add strength where the piece is grooved. One piece is drilled and the other is tapped to receive 5/16 in. 18 thd. machine screws. A 3/8-in. stud is screwed and riveted in place to serve as a tail. — C. A. P.



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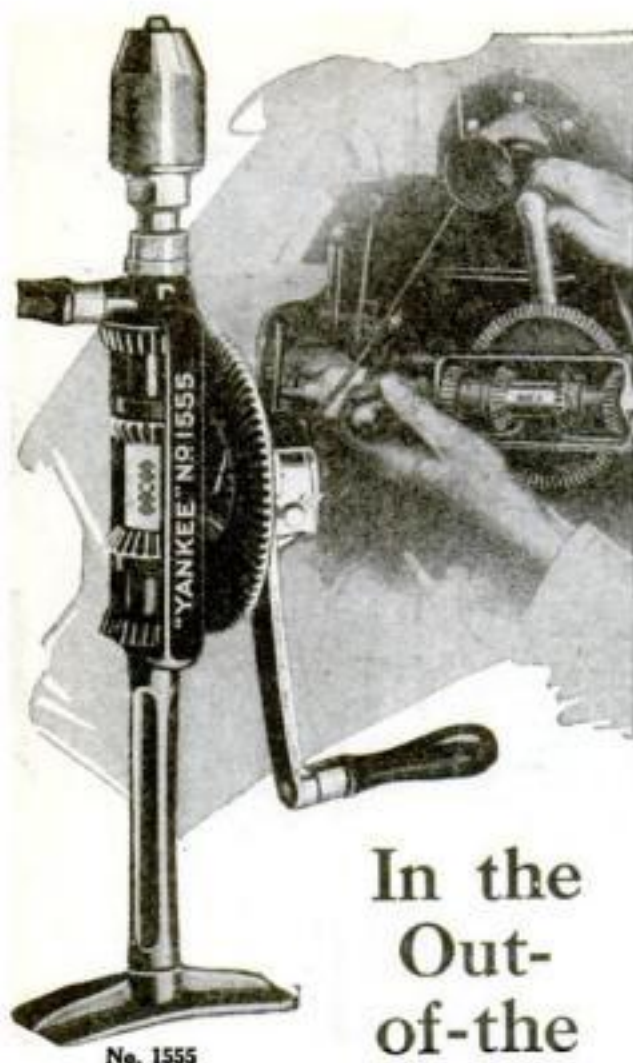
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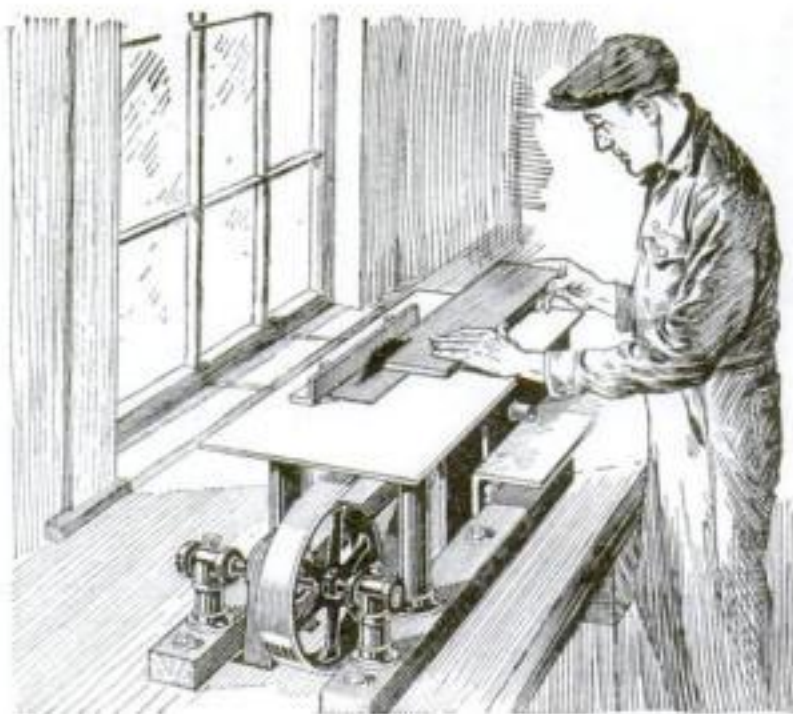
By Frank N. Coakley

boring machine
molding machine
THIS combination bench saw, boring and molding machine is one of the most useful machines for the home workshop or any small woodworking shop in which standard woodworking machines are not available.

The top plate is a piece of $\frac{1}{4}$ -in. plate 19 in. wide and 3 ft. long, with a slot cut in it 6 in. wider than the saw to allow the

mandrel. This allows a cutter head to be used to make moldings, the cutting head being under the table angle. When boring a hole, the table is lowered to the position shown and a standard chuck used to hold the bit.

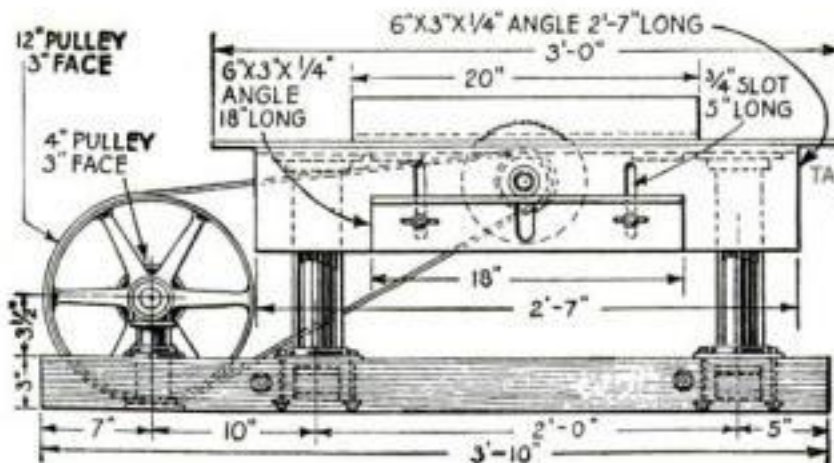
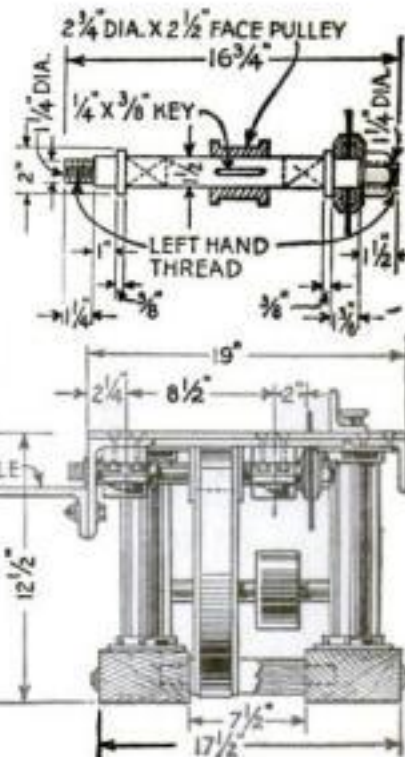
Standard $2\frac{1}{2}$ -in. pipe is used to form the supports. These are fastened to oval floor flanges, which are securely



STANDARD 2" PIPE TEE
BABBITTED FOR
 $1\frac{3}{4}$ " SHAFT

STANDARD
2" PIPE

STANDARD 2"
PIPE FLANGES



The completed saw driven by a motor beneath the bench, the side and end views showing adjustable table for boring and molding, and details of the mandrel and countershaft bearings

saw to be removed from the mandrel for sharpening or replacing. This slot should be made about 18 in. long and a piece of quartered oak placed in it, the wood being held with bolts to two flat pieces under the table.

The mandrel, which is fully detailed, is securely held in place by two bearings of any standard commercial design. All the parts that are fastened to the top plate are held by countersunk bolts. The top plate, of course, must be well finished and perfectly smooth. The gage plate or guide angle is held in place by two $\frac{3}{4}$ -in. tightening screws, which are allowed to slide in two slots in the top plate.

A 3 by 6 by $\frac{1}{4}$ in. angle is fastened to the under side of the top plate. This angle is provided with a 3-in. hole in proper location to allow the end of the mandrel to pass through, and it also is slotted so that the table for the boring and molding side of the machine may be lowered or raised as necessary. The table angle is slotted so as to pass the

bolted to two pine or oak pieces 3 by 5 in. by 3 ft. 10 in. long. These wooden pieces are connected by two cross members, as indicated.

The saw mandrel is driven by a countershaft, which is made and held in place as shown in the detail in the upper right-hand corner of the accompanying illustration, 2-in. standard cast-iron tees being babbitted to form the bearings. A 2-in. belt is used to drive the saw from the countershaft. The saw, which is 7 in. in diameter, should be run at between 1500 and 1800 revolutions a minute.

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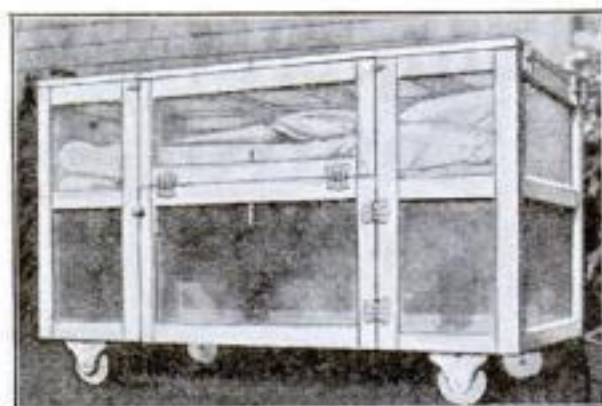
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GENERAL ELECTRIC

Baby's Crib and Play Pen Built from Home Workshop Blueprint

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This crib was constructed by Charles C. Greenman with the aid of Home Workshop Blueprint No. 26

portant parts, the types of joints, and the method of applying hardware and fittings.

The baby's crib and play pen illustrated was made from Blueprint No. 26 by Charles C. Greenman, of Bedford, Halifax Co., Nova Scotia, Canada. He says:

"I hope you will continue issuing these prints as they certainly are great. I have had several and expect to start the kitchen cabinet table in a few days' time."

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9... 7 x 26 x 3/16	

Other sizes are cut to order from sheet Celoron. Ask your dealer.

An interesting booklet for the radio set builder is "Getting the Right Hook-up." This booklet is sent free upon request.

To radio dealers: Send for special dealer price list showing standard assortments

Diamond State Fibre Company

BRIDGEPORT

(near Philadelphia)

PENNSYLVANIA

Branches in Principal Cities
Toronto, Canada—London, England

CONDENSITE CELORON STANDARD RADIO PANEL



GERSTNER CASES
are GOOD Cases
Machinists, Toolmakers
and other particular
mechanics appreciate
their splendid quali-
ties. Catalog free.
Write for it to-day.
H. GERSTNER & SONS
503 Columbia St., Dayton, O.



One Charger for All Batteries

Charges 2-volt peanut tube
batteries, 6-volt A Batteries,
6- and 12-volt automobile
batteries, and 1 to 4 B Bat-
teries. It's the

**Valley Type ABC
Battery Charger**

VALLEY ELECTRIC CO., St. Louis, Mo.



"WONDER" COLD PIPE, TUBING & BAR BENDERS

Standard of the World
HAND AND MOTOR OPERATED
14 Sizes of Machines
What it costs to bend pipe our
way. Per bend.
1" pipe 5 cents 4" pipe 25 cents
2" pipe 10 cents 6" pipe 60 cents
3" pipe 15 cents 8" pipe \$1.00
Send for Catalogue.

AMERICAN PIPE BENDING MACHINE CO.
51 Pearl St. One Year to Pay. Boston, Mass.



The Midget "Five-in-One" Slide Rule

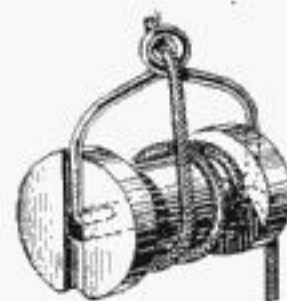
is a combination Mannheim, Poly-
metric, Log-Log, Binary, Add and Sub-
tract Slide Rule. It will instantly add,
subtract, multiply and divide any com-
bination of whole numbers, fractions,
mixed numbers and decimals. Gives
every root and power, also Logs, Sines
and Tangents. Made of aluminum with
scales on white celluloid. Size 4 in.
Approved and adopted by colleges.
Price with instructions, \$1.50. Leather
Case 50c extra. Catalogue Free.
Gilson Slide Rule Co., Niles, Mich.

(Patented 1-17-22)

Spool Provides Adjustment for Electric Droplight

THIS spool adjuster for droplights is a simple but not unsightly device that will line up the lamp cord quickly and effectively.

At the inner edge of one rim of a large spool a hole is bored through to the central hole, and through this is passed the lamp cord. At the other rim cut a groove in the outer surface, as indicated. This engages one arm of the wire hanger. The edges of the groove should be rounded to permit the spool to be wound either way. At the same time, the groove and wire act together as a sort of ratchet and prevent the spool from unwinding by itself. The cord extending from the spool to the light always remains the same length.—ROLAND B. CUTLER.



Spool and wire sling

Readers Report Fine Results with Unique One-Tube Radio Set

MANY letters have been received from readers telling of the exceptional results they have obtained with receiving sets built in accordance with the constructional article, "One-Tube Radio Set Operates Loudspeaker," in the January issue of POPULAR SCIENCE MONTHLY.

C. B. Cooper, M.D., of Grandview, Tex., writes:

I copied your hook-up in the January issue and finished it at 12 midnight, December 10, 1923. Tuned in KPO, San Francisco (1400 miles), so loud on head set that I put it on a standard loudspeaker with one stage of audio-frequency amplification. This shows that the hook-up discounts distance wonderfully.

George A. Allen, Miami, Fla.:

I bought POPULAR SCIENCE MONTHLY on Saturday and by Sunday evening had the one-tube set going. At once got WOC (Davenport, Ia.), 1200 miles away, which I never heard before on two standard five-tube sets I have used. Also got WBAP, WRC, WEAF, WOR (Newark, N. J.), WJZ, WMC, WOS, and WWJ (the two latter stations I never had heard before). These were not just audible, but strong enough to be entertaining.

David Whyte, Poughkeepsie, N. Y.:

I have just completed the one-tube receiving set according to your January article and am very pleased to say that I have found this set more than satisfactory and very selective. I should be glad to recommend this hook-up to any one who wishes to build a one-tube set cheaply.

C. S. Conrad, Lima, Ohio:

I have tried several hook-ups for radio and in the last issue (January) of POPULAR SCIENCE MONTHLY found what I wanted. The stations received in one evening are as follows: KDKA, WGR, WOR, WLW, WOS, WRC, WGY, WDAP, WBAY, WOC, WBAD, KOB (State College, New Mexico), WFAA, WBAP—not so bad for the second time the outfit was in operation.

Any one who overlooked this noteworthy article in the January number can obtain that issue from the Circulation Department, POPULAR SCIENCE MONTHLY, 225 West 39th St., New York, for 25 cents as long as there are copies left.

RED lead is being used effectively for priming exterior woodwork, especially such woods as Southern pine, cypress, and spruce, which sometimes are full of sap. When the orange color is objectionable, it is covered by two coats of white-lead paint.



"Red Devil" Tools

Make Your Everyday Repair Jobs Easy

"Red Devil" Chain Drill, No. 2018 drills through metal as easily as an auger bit through wood. You take the tool to the work, instead of the work to the shop. It's automatic.

Price each, \$4.80.



"Red Devil" Glass Cutter, No. 024—the most popular glazier's tool in the world. The hand honed cutting wheel cuts the glass clean, clear and sharp. It's economical to do the little jobs yourself with it.

Price each, 20c.



"Red Devil" Slip Joint Plier No. 850—an all-around practical tool with wire cutter, burner grip, and flat nose plier. Slip joint gives wide range to gripping jaw. About as useful a tool as any mechanic can own.

Price each, \$1.30



"Red Devil" Hack Saw Frame No. 1048. Adjustable for 8 to 12 inch blades. Depth of cut $3\frac{1}{4}$ inches. The steel frame is strongly constructed.

Price each, \$1.00.

THEY reduce difficult problems in the home, the office, the workshop—around the car, to surprisingly easy tasks. There is the right tool for the right job. There's no end to the number of useful things you can make and mend with them. They help you keep things in order—help you save. Forged of steel for strength.

The following are a few "Red Devil" Tools and their suggested uses:

Chain Drills:

for drilling iron, the engine cylinder, truck frame, angle irons, pipe, wagon tires, for brick, concrete, etc.

Glass Cutters:

for repairing windowpanes, glass sashes, greenhouses, for making passepartouts, table tops, glass trays, aquariums, etc.

Pliers:

for repairing radio sets, gas engines, motorcycles, automobiles, trucks, tractors, vacuum cleaners, sewing machines, guns, typewriters, toys, for amateur plumbing jobs, etc.

Hack Saw Frames and Blades:

for cutting sheet metal, pipe, tubing, cables, structural steel, etc.

"Red Devil" Tools also comprise a complete line of Auger Bits, Screw Drivers, Snips, Wrenches, Cold Chisels, Bolt Cutters, etc. Be sure to look for the "Red Devil" trade mark on each and every tool. Your dealer has them in stock—if not, he can get them for you.

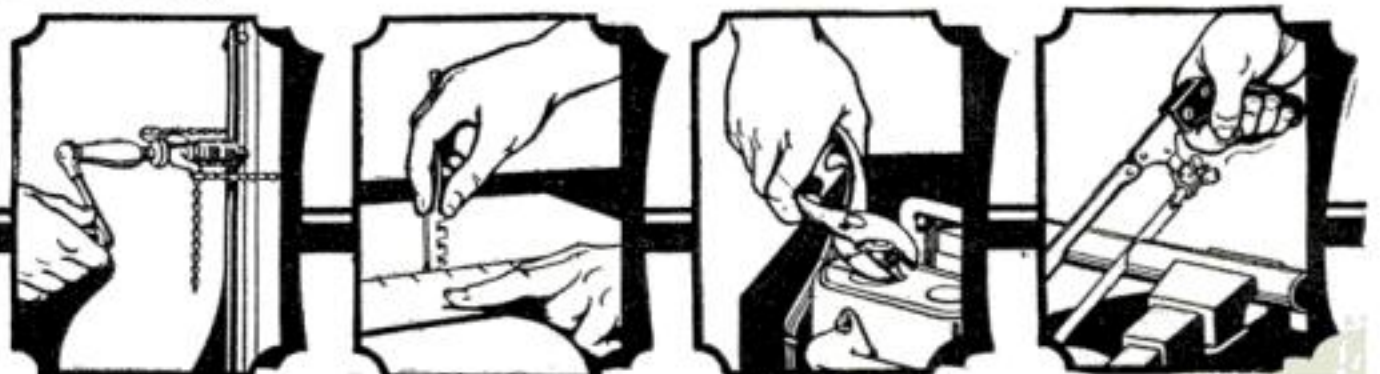
Send for the "Red Devil" Mechanic's tool booklet—a handy reference guide for users of good tools.

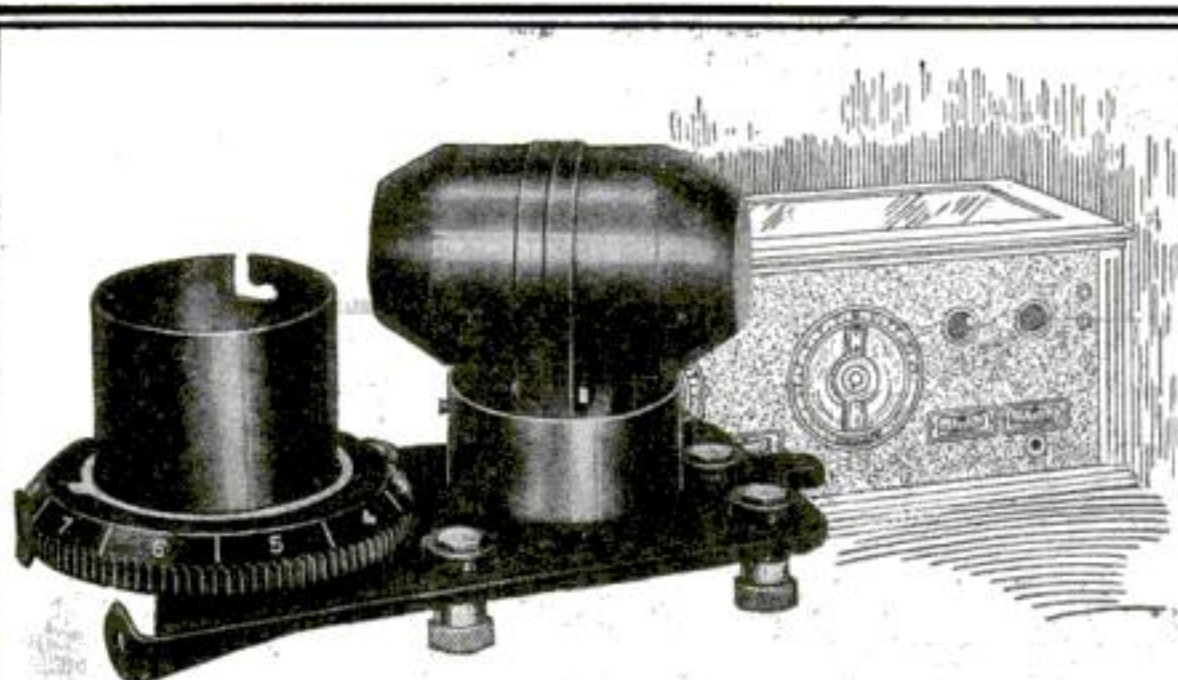
Smith & Hemenway Company, Inc.

Manufacturers of "Red Devil" Tools

264 Broadway

New York





Announcing—

A New Radio Frequency Transformer

—in a combination unit, consisting of transformer, tube socket and rheostat.

Especially designed for use in tuned radio frequency circuits—the most practical method of amplifying high (radio) frequency impulses.

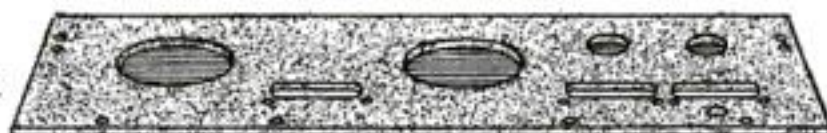
The trend toward radio frequency amplification is to be expected. Its advantages are many—long distance reception; the excellent results obtained with indoor aerials, and an entire absence of interference with neighboring receivers.

When incorporated in a tuned radio frequency circuit, this transformer amplifies efficiently at all wave lengths employed in present-day broadcasting.

All Eisemann units are matched one to the other, not only in their electrical co-relation but also in appearance, and, when assembled, present a harmonious whole.

Complete instructions for wiring are given, and the individual not deeply versed in Radio can build a receiver with assurance of results.

Catalog sent on request



EISEMANN MAGNETO CORPORATION

WILLIAM N. SHAW, President

40 Thirty-Third Street

Brooklyn, N. Y.



Chinese Game Table

(Continued from page 81)

1 7/16 by 2 1/8 in. The eight end bins are pieces 1 1/8 by 1 11/16 by 5 in., hollowed in the upper surface. The eight center bins are 1 1/8 by 1 11/16 by 10 3/16 in. The 12 bin divisions are 1/4 by 1 1/8 by 1 9/16 in. The four filling pieces that form the inside partition between the bins and the playing surface of the table are 5/16 by 1 3/16 in. by 2 ft. 11 1/8 in. They are notched at each corner (Fig. 3, page 83) so as to allow four small lids to be used for the four square corner compartments. These compartments, the construction of which is clearly shown in Fig. 3, are for holding the dice and other small objects.

The main table top or center board is glued up from pine or poplar 3/8 in. by 2 ft. 7 in. by 2 ft. 7 in. It is covered with cork, cork linoleum, or rubber 1/4 in. thick, and with a piece of felt table cover 2 ft. 9 in. by 2 ft. 9 in. The cloth is turned over and tacked to the board base edges.

The whole top is simply dropped into place and fastened with screws from underneath the table frame. The ashtrays in this case are turned from 1 1/4 by 2 1/2 by 2 1/2 in. wood with glass inserts. Beside the hinges, four brass elbow brake braces or stays 10 in. long, and four silent caster domes 1 in. in diameter are needed.

Obtaining an Oriental Finish

One of the most effective finishes for the table is an Oriental black. This is obtained by giving one priming and one finishing coat of flat red paint, preferably vermilion coach color, but, in any event, a very brilliant red of fine quality. The second coat is smoothed with 00 sandpaper and then covered with one or two coats of rich black furniture enamel. The final coat is rubbed vigorously with FF powdered pumice-stone and rubbing oil, raw linseed oil, or sewing-machine oil. The enamel is rubbed hard so that the vermilion shines through in places and gives a warm underglow. The general tone is then one of an antique Oriental piece, black lacquered over red.

This type of table is also frequently finished in ivory black and occasionally in walnut or mahogany.

The shop drawings of this table, with full-size details of the essential construction and a completely itemized bill of materials or cutting list, are contained in Blueprint No. 32 of the Home Workshop series. This can be obtained for a nominal charge of 25 cents from the Blueprint Service Department, POPULAR SCIENCE MONTHLY, 225 West 39th St., New York.

For the Woodworker

TWO practical designs for dining alcoves will appear in the April Home Workshop.

Among other articles scheduled for early publication is one by Edwin M. Love on time-saving tricks of the carpenter's trade for home workers, another by S. W. Blanchard, "Habitant' Chairs, Built by Home Craftsmen," and a third on building a corner china closet.

We Want Agents at \$50 to \$90 a Week



New Invention—Just out. Needed in every home every day. Patented. Nothing else like it. Low priced—**Sells on sight.** Sharpens any kitchen knife, paring knife, carving knife, bread knife, or shears and scissors in **ten seconds.** Mechanical masterpiece. A child can use it. Just put knife in slot—turn crank—sharpens both sides at once automatically. **We want representatives at once—men and women hustlers.** Get this position where **profits start first day.**

No Experience Necessary—200% Profit

Make as much money next week as these men are making now. J. C. Lewis, of Kansas, says: "I have sold one hundred sharpeners in four days." Hobart Kerr, of Md., writes: "The women can hardly wait till they get them." Herbert Cain, of Ky., sold nine after supper. At the end of the first day, J. W. Gordon, of Pa., writes: "I sold two dozen and I sold to every one I saw." Wm. G. Hall, of N. J., says: "I think it is great. I sold six in about one-half hour. The machine is a mighty fine proposition. I am a mechanic and I know what I am talking about." You can make this money. **WRITE TODAY. TERRITORY FREE.** Get busy at once.

QUICKEDGE SHARPENER CO. 663 Sharpener Bldg. Jackson, Mich.

Only

\$2

Selling Price

The Quick-Edge Knife and Shear Sharpener



*The blustery, rainy
days filled with
joyous entertainment*

TO experience the thrill of supreme radio enjoyment, add to your equipment a Magnavox Combination Set as here illustrated.

This instrument combines a Magnavox Electro-Dynamic Reproducer and Power Amplifier in one marvelous unit—with it you can reproduce those distant stations you have always wanted to hear.

The first trial will convince you that Magnavox Combination Sets are a notable contribution to the radio art.

For permanent radio satisfaction choose Magnavox.

Magnavox Reproducers: M1 (for dry battery sets); R2 and R3 (electro dynamic) . . . \$35 to \$60

Magnavox Combination Sets: electro-dynamic Reproducer with one or two stages of amplification \$59 to \$85

Magnavox Power Amplifiers: may be had in one, two or three stage (audio-frequency) \$27.50 to \$75

Magnavox Products are for sale at good dealers everywhere. Write for catalogue.

THE MAGNAVOX CO.
Oakland, Calif.

New York Office: 370 SEVENTH AVE.
Perkins Electric Limited: Toronto, Montreal,
Winnipeg, Canadian Distributors

*For Every Receiving Set
there is a MAGNAVOX*

Exit Variocoupler Enter Erla Selectoformer



Combines Improved Properties of Coupler and Wavetrap

Again Erla contributes notably to radio advancement. Erla Selectoformer, replacing alike variocoupler and wavetrap, greatly increases volume and selectivity in radio receivers, at the same time reducing cost.

Selectoformer, as the name implies, operates simultaneously as a selector and radio frequency transformer, picking off of the antenna the one wavelength desired and amplifying it to normal strength.

Thus is avoided the interference common to receivers that depend for selectivity upon tuning the coarse antenna system. Also, because of the amplification brought to bear, there is eliminated the loss of energy encountered in wavetraps of conventional type.

With Selectoformer, distant signals come in loud and clear, even with powerful local broadcasting in progress. Tone quality, likewise, is greatly improved, through reduction of static and other disturbances.

Control of the Selectoformer is effected through the 23-plate condenser already built into most receiving units. Installation is a matter of moments only.

For complete details regarding this and other Erla improvements, including latest reflex circuits, ask your dealer for Erla Bulletin No. 20, distributed gratis; or write, giving your dealer's name.

Electrical Research Laboratories
Dept. F 2515 Michigan Ave., Chicago

ERLA



Superior worth of Erla audio transformers, shown in their exclusive ability to amplify three stages without distortion, improves any set. \$5



Erla condensers alone carry a certificate of accuracy on their labels. Look for the words "Tested Capacity" when buying. 35c to 75c ea.



Patented telescoping rim of Erla bezels fits any 1/8" to 1/4" panel, neatly screening openings required for tube ventilation. Nickel or enamel, 20c



Reliable and clear reception is assured through the Erla fixed crystal rectifier, requiring no adjustment and lasting indefinitely. List \$1

Trap Shooting with Homemade Catapult and Tin "Birds"

By John Edwin Hogg

NEXT to game hunting, shotgun shooting at clay birds, or other forms of flying targets, offers the most alluring sport with the gun. Clay-bird shooting, however, is denied to many sportsmen because of the expense. In an effort to reduce the cost, the writer recently developed the catapult illustrated, which hurls tin cans aloft for use as shotgun targets. Only \$3.70 worth of lumber and hardware was used to build the catapult.

It consists of a wooden frame stoutly reinforced with metal cleats, and a wooden hurling arm, to which motive power is supplied by stretching two discarded motor tubes. Light and compact, the catapult may be hauled



Shooting at the tinware birds (above); ready to spring the catapult (below)

to and from the shooting grounds on the runningboard of a small roadster.

On the shooting grounds it is necessary to have on hand only a supply of old tin cans. The hurling arm, which is pressed downward to bring the inner tubes under tension, is latched and the cans are placed on the arm. A cord fastened to the latch frees the hurling arm at the will of the shooter. The arm flies up, strikes the top of the frame, and the tinware keeps on going—usually about 100 ft. in the air.

The shooting grounds chosen for experimentation with the catapult is near the city dumping ground at Alhambra, Calif., where there is an unlimited supply of tinware to be shot at. Once built, and transported to the scene of activities, the operation of the catapult costs nothing. It will throw tin cans all day to provide a most excellent and inexpensive form of shotgun target shooting.

Keeping an Auto Tuned Up

EVERY motorist will find many labor- and money-saving suggestions in a new series of articles by Ray F. Kuns, the first of which is scheduled for early publication in the Home Workshop Department. His first article tells how to eliminate spark-plug trouble and he cites as an example a motorist who makes a set of plugs last at least 28,000 miles.

Deafness



Perfect hearing is now being restored in every condition of deafness or defective hearing from causes such as Catarrhal Deafness, Relaxed or Sunken Drums, Thickened Drums, Roaring and Hissing Sounds, Perforated, Wholly or Partially Destroyed Drums, Discharge from Ears, etc.

Wilson Common-Sense Ear Drums

"Little Wireless Phones for the Ears" require no medicine but effectively replace what is lacking or defective in the natural ear drums. They are simple devices, which the wearer easily fits into the ears where they are invisible. Soft, safe and comfortable.

Write today for our 168 page FREE book on DEAFNESS, giving you full particulars and testimonials.

WILSON EAR DRUM CO., Incorporated
730 Inter-Southern Bldg. Louisville, Ky.

21 Jewels
Nothing less than 21 Ruby and Sapphire Jewels is good enough for Burlington masterpiece.
Quality and Style
Adjusted to the second—temperature—synchronism—positions. 25 year Gold Strata Case, in 100 designs. \$1 down. Balance in small monthly payments. Send for free book.
Burlington Watch Company
19th Street and Marshall Blvd. Dept. 13-63 Chicago, Illinois

BURN YOUR NAME ON TOOLS WITH ARKOGRAF
Protect your tools from theft. Write any name, engrave any design on metal with electricity like writing on paper with pen or pencil. Complete outfit \$3.50, prepaid anywhere. Interesting descriptive circulars free. Write to-day. Agents wanted.
Arkograph Pen Co., 481-A East Couch St., Portland, Oregon

A Radio Statement to the Public

The Meaning of Coordinated Scientific Research

KEEPING its pledge to the public, the Radio Corporation of America has concentrated its vast research and engineering forces upon the solution of certain fundamental problems facing the art—problems which have become more apparent as broadcasting stations and radio receivers multiply.

The phenomenal expansion of the radio industry, and the universal and ever-increasing appeal of radio represent an outstanding development of the present century—for this industry has grown from infancy to maturity in a space of but two years.

. . .

Briefly stated, there is today a necessity for

—*A radio receiver providing super-selectivity*—the ability to select the station you want—whether or not local stations operate. A selectivity which goes to the theoretical limits of the science.

—*Super-sensitiveness*—meaning volume from distant stations—along with selectivity.

—*Improved acoustics*—more faithful reproduction of broadcasted voice and music than has ever been possible before.

—*“Non-radiating” receivers*—a new development, a type of receiver which, no matter how handled, will not interfere with your neighbor's enjoyment.

—*More simplified operation*—a super-receiver requiring no technical skill, thus making the greatest achievements of entertainment immediately available to all members of the family.

—*A receiver for the apartment house* and populated districts, requiring neither aerial nor ground connection.

—*Another type of improved receiver for the suburban districts*, equally capable to that above, for use where the erection of an aerial presents no problem.

. . .

Painstaking search in quest of these ideals has led to new discoveries, setting new standards of excellence and performance—discoveries which have established:

First—that improved acoustics are possible—a matter of scientific research and not of haphazard design—for truly melodious reception.

Second—that dry battery operated sets can be so designed as to give both *volume* and distance.

Third—that the regenerative receiver is susceptible to marked improvement providing selectivity, sensitiveness and simplicity of operation hitherto deemed impossible of accomplishment.

Fourth—that the Super-Heterodyne—the hitherto complicated device requiring engineering skill to operate—could be vastly improved—improved in sensitiveness and selectivity—and simplified so that the very novice and the layman could enter new regions of entertainment and delight.

Watch For Further Announcements

Radio Corporation of America

Sales Offices:

233 Broadway, N.Y.C.

10 So. LaSalle St., Chicago, Ill.

433 California St., San Francisco, Cal.

Radiola

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HIGH SCHOOL COURSE IN TWO YEARS

YOU ARE BADLY HANDICAPPED if you lack High School training.

You cannot attain business or social prominence. You are barred from a successful business career, from the leading professions, from well-paid civil service jobs, from teaching and college entrance. In fact, employers of practically all worth-while positions demand High School training. You can't hope to succeed in the face of this handicap. But you can remove it. Let the American School help you.

FIT YOURSELF FOR A BIG FUTURE

This course, which has been prepared by some of America's leading professors, will broaden your mind, and make you keen, alert and capable. It is complete, simplified and up-to-date. It covers all subjects given in a resident school and meets all requirements of a High School training. From the first lesson to the last you are carefully examined and coached.

USE SPARE TIME ONLY

Most people *idle* away fifty hours a week. Probably you do. Use only one-fifth of your wasted hours for study and you can remove your present handicap within two years. You will enjoy the lessons and the knowledge you will gain will well repay the time spent in study.

Check and mail the coupon NOW for full particulars and Free Bulletin.

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Send me full information on the subject checked and how you will help me win success.

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|Automobile Engineer |Photoplay Writer |
|Automobile Repairman |Mechanical Engineer |
|Civil Engineer |Shop Superintendent |
|Structural Engineer |Employment Manager |
|Business Manager |Steam Engineer |
|Cert. Public Accountant |Foremanship |
|Accountant and Auditor |Sanitary Engineer |
|Bookkeeper |Surveyor (& Mapping) |
|Draftsman and Designer |Telephone Engineer |
|Electrical Engineer |Telegraph Engineer |
|Electric Light & Power |High School Graduate |
|General Education |Fire Insurance Expert |
|Vocational Guidance |Wireless Radio |
|Business Law |Undecided |

Name

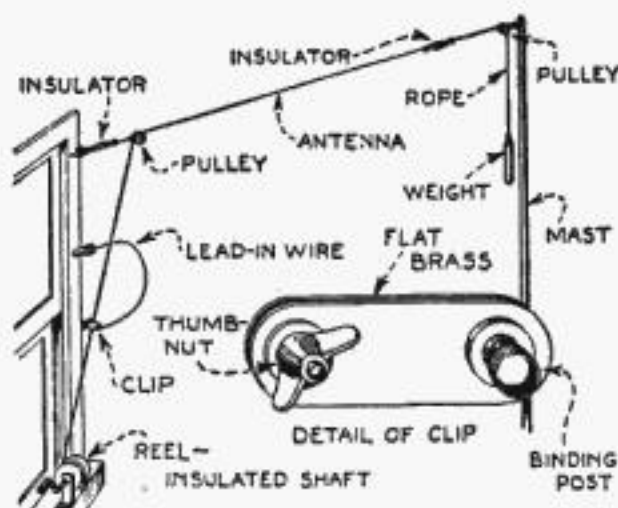
Address

Aerial with Length Adjustment Improves Radio Reception

By L. B. Robbins

FOR maximum efficiency in radio reception, the antenna must be the right length. Some radio fans have several aerials of different lengths, but this is not necessary if the antenna is adjustable.

Erect the masts at the greatest possible distance apart, say 200 ft. The farther mast from the set should have a fixed pulley at its peak; the nearer mast an insulated pulley fastened by means of a short rope. Provide a 225-ft. antenna



By reeling in or letting out the aerial, the utmost efficiency is insured

and fasten the farther end to an insulator, which is fastened, in turn, to a rope that runs down through the fixed pulley and ends in a weight.

The near end of the antenna is then run down through the suspended pulley and fastened to a reel with an insulated shaft and drum. When the reel is wound up, the antenna is pulled toward the nearer mast and thus shortened. When the reel is unwound, the weight carries the antenna up again and stretches its length between the masts.

The vertical part of the wire acts as part of the lead in. A clip can be clamped on this lead-in wire at the most convenient point. Any kind of clip can be used, but one that will be positive and will stand the wear and tear is illustrated.

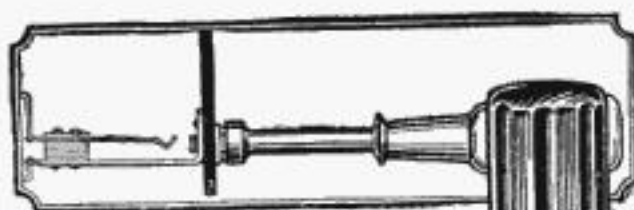
Extending Usefulness of Pliers

WHEN using ordinary pliers for handling a number of small things, they usually may be made to open automatically by winding a rubber band around the handles, close up to the joint. This will not prevent their closing.

To use a pair of pliers as a small vise, hold the jaws together with a small C clamp, such as may be obtained at hardware stores for about 10 cents.—E. A. M.

A GOOD soldering flux can be made by dissolving powdered rosin in alcohol and adding a little glycerin to prevent drying or caking. This may be used with thin wire-solder and a well-tinned soldering copper to produce perfect electrical connections.

Electricity
Short, soldering



Spin All Nuts On—

IT'S so easy now—assemble any radio hook-up in half the time—make connections leakproof as soldering with

Stevens SPINTITE Wrenches

Fit all radio nuts. Hollow stem goes over projecting screws—hex socket gets full grip and protects nut—ebonized handle for comfortable leverage—cinch to reach difficult places. All sizes from 3/16 to 1/2 inch.

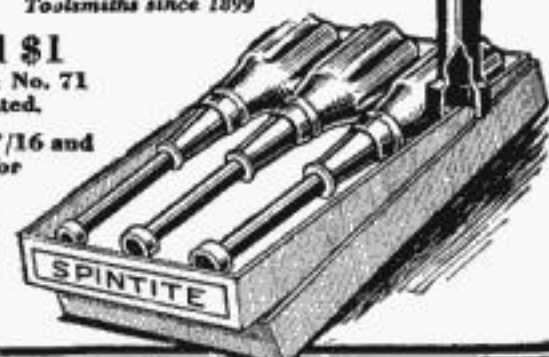
STEVENS & CO.

375 Broadway, Dept. 21 New York
Toolsmiths since 1899

Send \$1

for Set No. 71 illustrated.

Sizes 7/16 and 1/2" for phone jacks, 65c. each.



Stevens **SPEED UP** Tools

The MONARCH Jr. Lathe

Is Priced Within Your Means

Most efficient machine tool you can have in home workshop, repair shop or garage too. Turns out, with 1000th-inch accuracy, all small wood and metal parts that other lathes will. Experimenters, inventors, mechanics enthusiastic over it. Completely equipped auto. safety devices; semi-quick change gear.



9" lathe—
2 1/2 ft. bed—
with bench legs

Send for FREE Catalog \$245

Also built with bed lengths up to 5 feet. Made in 11-inch swing size too, at slightly higher price.

THE MONARCH MACHINE TOOL CO.
401 OAK STREET SIDNEY, OHIO

A NEW WAY TO GET YOUR CLOTHES ABSOLUTELY FREE

and Make Big Money during your spare time—something different, better, bigger, more liberal than any offer ever made. Lower prices—better clothes—bigger cash profits—express or postage paid on everything.

DOUBLE PAY

Free Clothes and Cash Profits Besides. You can easily earn \$30.00 cash, extra, every week during your spare time, taking orders for our made-to-measure clothes. We don't ask you to use your cash profits for your own clothes. That's not our way of doing business. Ours is a new and better plan.

Fifty-six stylish, real cloth samples—FREE colored fashion plates; inside wholesale prices—everything FREE. Just drop us a line today and we will send complete outfit FREE.

SPENCER MEAD CO., Dept. C517 Chicago

\$3 Cash Buys Typewriter



Balance Only \$5 Monthly

Save 35 to 60% on all standard makes—Underwood, Royal, Remington, etc. Every machine thoroughly rebuilt and GUARANTEED. Try five days at our expense before you buy.

WRITE at once for Free Descriptive Circular and Special Low Prices.

Wynn Typewriter Exchange 21 Reliance Bldg. Kansas City, Mo.

5 DAYS FREE TRIAL



This Radio Catalogue FREE

Save $\frac{1}{3}$ on Guaranteed Radio Equipment

Write us a post card

Address Dept. 5-R

and we will send you free this 52 page catalogue of radio sets and parts. It also contains explanation of radio terms, map and list of broadcasting stations and much radio information, including an explanation of successful hook-ups and circuits.

You will be amazed at the low prices Ward's quote. A complete tube set having a range of 500 miles and more, including tube, head set, batteries, and antenna equipment, as low as \$23.50.

This catalogue contains everything for the expert and amateur. Complete sets and every improved part for building sets, all the most up-to-date devices—at the lowest possible prices.

Headquarters for Radio

Montgomery Ward & Co. is headquarters for Radio, selling everything direct by mail without the usual "Radio-profits." Why pay higher prices? Ward quality is the best and the prices will often save you one-third. Everything sold under our Fifty Year Old Guarantee—Your Money Back if You Are Not Satisfied. Write today for your copy of this complete 52-page Radio Book.

Write to our house nearest you. Address Dept. 5-R

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St. Paul
Oakland, Cal.

Portland, Ore.

Montgomery Ward & Co.

Established 1872

The Oldest Mail Order House is Today the Most Progressive

"What a whale of a difference
just a few cents make!"

— all the difference
between just an ordinary cigarette
and—FATIMA, the most skillful
blend in cigarette history.

Home Protection

with an
ASTRA
Automatic
will cost little



Nearly every man wants a gun in the house—he feels better able to protect his family. We are able to offer these Genuine Astra guns at special prices because we bought before recent tariff raises became effective. Really fine guns, beautifully finished, hard hitting. Use standard ammunition. Order direct from U. S. importers.

\$7.75 25 calibre—7 shot—C. O. Q. Automatic.
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9.95 25 calibre Astra with triple safety.
10.95 32 calibre—10 shot Astra, extra magazine.
16.95 32-20 and 38 cal. swing-out cyl. revolvers.

We guarantee every gun against defective workmanship; brand new; of Drop Forged Steel Throughout. Before buying any weapon **INSIST** on this guarantee. **SEND NO MONEY** unless you wish. State model desired—pay postman on delivery plus postage. Satisfaction guaranteed or money refunded. Write for new firearms catalogue.

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I Teach By Mail

I can make a good penman of you at your home during spare time, no matter where you live or how poorly you now write. My simplified system has shown thousands the way to good penmanship during the past twenty-five years—it CAN and WILL do the same for YOU—

Thos. C. Swayne
My system shows and tells how the wonderful improvement I made in less than six months after beginning your course.

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It contains many beautiful specimens of penmanship showing what others have accomplished by the Tamblin System, with testimonials and general information about our course—(Your name elegantly written on a card if you enclose stamp for postage). Ladies taught as successfully as men. **WRITE TODAY**, address

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437 Ridge Bldg., Kansas City, Mo., U. S. A.

F. W. Tamblin

Sturdy Flower Box and Stand Hold Indoor Garden

By Kenneth R. LaVoy

THE plant stand and flower box illustrated can be used for ferns, potted plants, or water-growing bulbs that will keep a bit of summer in the house all year round.

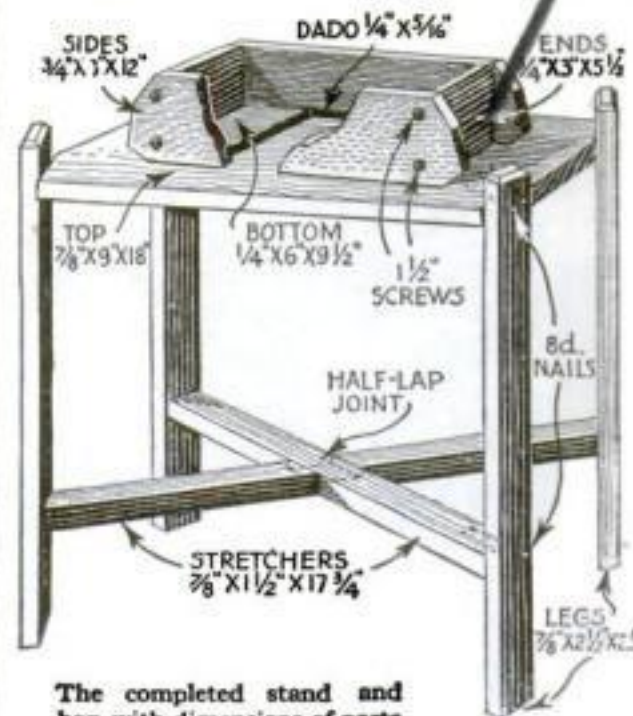
The materials needed for the stand are:

1 top, $\frac{1}{8}$ by 9 by 18 in.
4 legs, $\frac{1}{8}$ by 2 $\frac{1}{2}$ by 22 in.
2 stretchers, $\frac{1}{8}$ by 1 $\frac{1}{2}$ by 17 $\frac{3}{4}$ in.
Eightpenny finishing nails

For the flower box:

2 sides, $\frac{3}{4}$ by 3 by 12 in.
2 ends, $\frac{3}{4}$ by 3 by 5 $\frac{1}{2}$ in.
1 bottom, panel stock, $\frac{1}{4}$ by 3 by 9 $\frac{1}{2}$ in.
8 screws, $\frac{1}{2}$ in. No. 10, blue head
Bread tin to fit box
Putty, glue, stain, or paint and enamel

To build the plant stand, first prepare the legs and top. Then lay off on the top



The completed stand and box, with dimensions of parts

light penciled lines to represent the diagonal stretchers. Get the stretchers ready, allowing 1 in. extra length for fitting the ends. Place one stretcher on the top along the lines already laid out and mark the cross-lap joint from the lines indicating the other stretcher. Next, cut the ends to correspond in length with the top. Do the same with the other stretcher and cut the half-lap in both. If done carefully, the pieces will fit together.

In assembling, fasten the legs first to the top and then to the stretchers. The half-lap joint may be fastened with glue or with a $\frac{3}{4}$ -in. bright head screw from the under side. Use eightpenny finishing nails for assembling and set the heads so that the holes can be plugged with putty.

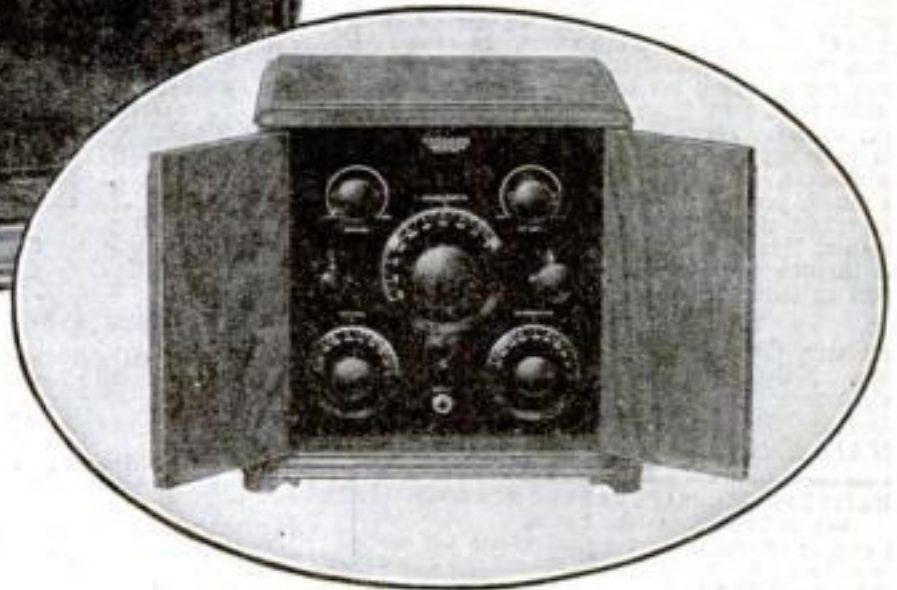
The dado on the sides and ends of the flower box is made with a combination plane or with a chisel. It should be at least $\frac{5}{16}$ in. deep to allow for the expansion of the bottom. First place one end and side together, put the bottom in position, and fasten the second side, leaving the other end until the last.

If the work is to be stained, hard wood should be used, but any soft wood will do for paint and enamel. A pleasing finish is to enamel both stand and box and then apply a simple stencil design to the sides of the box and on each leg of the stand.

A bread tin makes a cheap and water-tight lining, and can easily be moved, when necessary, to replace the flowers.



Paragon
Model III \$175.00



The Last Word In a Paragon Receiver for the Home

At last—a radio set that not only harmonizes with your furniture but adds to the attractiveness of any room in which it is placed. And not an ordinary radio set but a PARAGON.

Paragon Receivers are famous for the long distance records they hold which include the reception of the first trans-continental amateur message and the first trans-Atlantic message. It is a Paragon that keeps the world in touch with the MacMillan Expedition frozen in north of Greenland.

Paragon Receivers, because of their superior selectivity and sensitivity, are equally famous for the ease with which they can be operated and the clear results obtainable.

Now comes the latest Paragon, the Model III, pictured above, with all the advantages of the other models but housed in a mahogany or burled walnut cabinet which is a work of art.

In appearance, the Paragon Model III Receiver now matches up in every way to the perfection of the instrument itself.

Illustrated Bulletins of Paragon Radio Products are yours for the asking.

Dealers: We believe in the proper distribution of Paragon Radio Products. Our Exclusive Distributors are particularly interested in territorially protected dealers, who will concentrate, solicit and serve the consumer in the sale of Paragon Radio Receivers. If interested, write us for details.

ADAMS-MORGAN CO., - 18 Alvin Avenue - Upper Montclair, N. J.

PARAGON

Reg. U. S. Pat. Off.

RADIO PRODUCTS



"They've tripled your salary, dear"

"I TELL you, Tom, it was a lucky day for both of us when you sent in that I. C. S. coupon. You'd never be where you are to-day if you hadn't decided to study in spare time just when you did."

Spare-time study with the I. C. S. is winning promotions for thousands of men and bringing happiness to thousands of homes all over the world. In offices, shops, stores, mines, mills and on railroads, I. C. S. trained men are stepping up to big jobs, over the heads of older men, past those whose only qualification is long service. There is a job ahead of YOU. Some man is going to be picked for it. The boss can't take chances. He is going to choose a trained man with sound, practical knowledge of the work.

Get busy right now and put yourself in line for that promotion. You can do it in spare time in your own home through the International Correspondence Schools, just as thousands of other men and women have done.

The first step they took was to mark and mail this coupon. Make your start the same way—and make it right now.

MAIL THE COUPON TO-DAY!

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Clear Your Skin!

Your Skin Can Be Quickly Cleared of Pimples, Blackheads, Acne Eruptions on the face or body, Barbers Itch, Eczema, Enlarged Pores and Oily or Shiny Skin.

FREE Write today for my FREE BOOKLET, "A CLEAR-TONE SKIN," telling how I cured myself after being afflicted 15 years. \$1000 Cash says I can clear your skin of the above blemishes.

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\$3.85 AND UP

Liberty Custom Made Top. It's fun putting it on, simple directions furnished. Save a big labor bill. We are manufacturers of tops, side curtains and seat covers, for any make or model car. Amazing values. Special proposition for Fords, Chevrolets, Dodges and Maxwells. Write today for big money saving catalog.

LIBERTY TOP & TIRE CO., Dept. E-8 Cincinnati, Ohio



Home Workshop Chemistry

Simple Formulas that Will Save Time and Money

THE home workshop is not complete if a soldering iron is lacking. It is, therefore, important for the amateur mechanic to understand the uses of a few of the more common kinds of solder.

The strength of a soldered joint is only as strong as the solder used. For general work, a solder consisting of 1 part of lead and 1 part of tin is excellent. More lead can be used, but too much should not be employed.

An ordinary hard solder, which is fairly easy running and makes a strong joint, although it is rather red in color, consists of 70 parts of copper, 22 parts of zinc, and 8 of tin. A solder for iron, steel, and the bronzes consists of 53 parts of copper, 43 parts of zinc, 1 part of tin and a trace of lead.

Many radio enthusiasts still use crystal detectors. Since unmounted crystals are cheaper and offer a wider selection for sensitivity than mounted crystals, it pays to provide a low melting alloy suitable for mounting a crystal in a detector cup. Such an alloy consists of 4 parts (by weight) of bismuth, 2 parts of lead, 1 part of tin, and 1 part of cadmium. These metals can be purchased in small quantities from any large chemical house.

Place the bismuth, the lowest melting metal, in an iron spoon and heat over an alcohol or other flame until melted. Then add the other



Preparing a soft solder for radio work by melting easily fusible metals together, and casting the alloy in a mold of hard clay



metals one after the other. With few exceptions, the lowest melting metal is added first and, when this has melted, the next is put in.

If it is desired to cast the alloy or solder in bars, it can be done easily by pouring the melt into a mold of refractory substance. I use a block of good clay that was dried in a shaded spot for three

(Continued on page 128)



Those Saxophone Blues!

Drive away the blue devils, give your musical longing free expression, win new popularity with an "Inspiration" Saxophone!

Inspiration Leads the World!

Easiest to learn! Acknowledged the finest, sweetest, easiest playing Saxophone made! Absolutely pure tone! No buzz or rasp! Easy action! Always in perfect tune! Guaranteed quality! Exceptionally beautiful finish!

Free Trial—Easy Terms!

Write for FREE Catalog describing "Inspiration" Saxophones—Cornets—Trombones—Trumpets—Mellophones, etc., etc. Allequally supreme in tone and quality! Try your choice for week's FREE TRIAL in your own home. Easy monthly payments. Write TODAY!

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Special 5 Size Tap and Die Set, Only \$3.00

DIRECT FROM THE FACTORY TO YOU!

Our No. 12 Automobile Set furnished in our highly finished chestnut box contains 5 each taps and dies (1-4, 5-16, 3-8, 7-16, and 1-2"), in the S. A. E. thread, 1 die stock, and one tap and reamer wrench. Our No. 11 Set is the same as No. 12 except that the thread is U.S.S. instead of S.A.E. You are purchasing a splendid set at a very low figure. Send us your order at once and be one of our many satisfied customers. Let us also send you one of our circulars illustrating our full line of Handy Tools.

WORCESTER STEEL PRODUCTS CO.
Dept. M. 29 Union Street, Worcester, Mass., U. S. A.

Coto

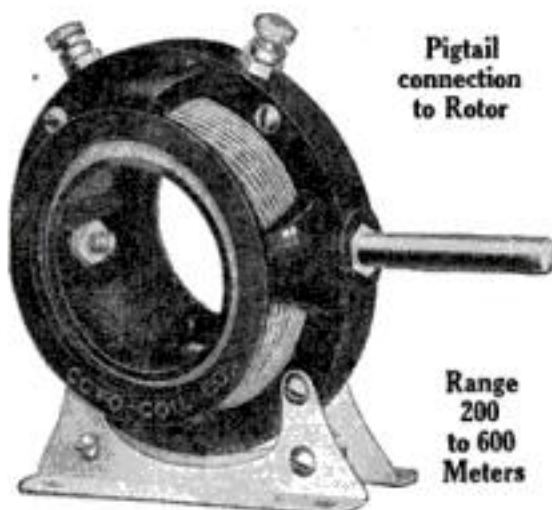
"Built First to Last"

Beginners, Experienced Amateurs and Experimenters Turn to Coto for Radio Parts

You can build from the very simplest radio set up to one with the latest refinements with Coto parts. And what is more fascinating than to try out the various circuits as they are published? And with Coto parts you know you will be getting the very best from these circuits. Learn the A. B. C. of radio—"Always Buy Coto."

Use All the Energy in Your Antenna

Don't waste it in the insulation losses of an inferior condenser. It's like pouring water in a sieve. The low losses of a Coto Condenser insure maximum signal strength. Use one and be convinced.



Pigtail connection to Rotor

Range
200
to 600
Meters

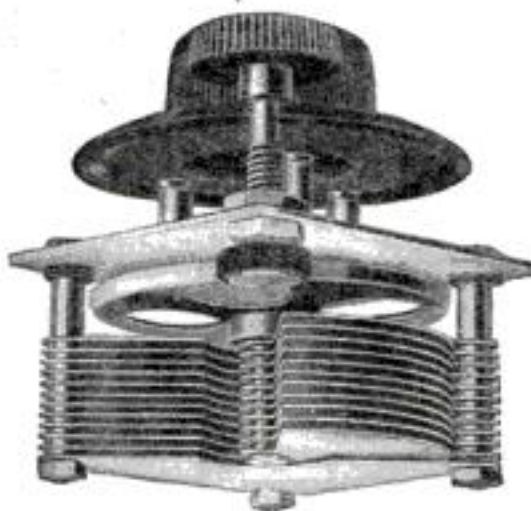
"So Much Better than Your Advertising Claimed"

These are the words of a pleased user of Coto Compact Moulded Variometer. He was surprised because of its wonderfully compact size ($3\frac{1}{4} \times 1\frac{3}{4} \times 3\frac{3}{4}$ in.) to find it splendidly efficient over the broadcasting wave lengths 200 to 600 meters. Price \$5. The Coto Moulded Variocoupler to match is just as fine, \$5.50.

The Tube with Double Grip and Hard Rubber Insulation



Cotogrip means positive contact, and the best radio insulation prevents leakages **85c**



Coto Variable Air Condenser WITH VERNIER

There is just one bearing in this condenser and that is protected with hard rubber, the best known radio insulator. Plates are of SILVER PLATED copper, soldered rigidly in place for lasting efficiency. Complete with vernier adjustment and handsome dial. Type 3505, .0005 Mfd. \$5. Type 3510, .001 Mfd. \$6.

GUARANTEE!

Every piece of Coto Radio apparatus is Laboratory Tested before shipment. So we authorize dealers and jobbers to guarantee you absolute satisfaction.

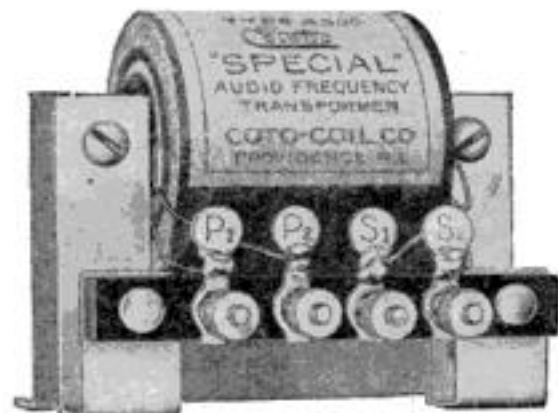
COTO-COIL CO.

87 Willard Ave., Providence, R. I.

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PERKINS ELECTRIC CO., LTD.
MONTREAL, TORONTO, WINNIPEG

"Superior to Any Other Regardless of Price"

Mr. W. R. Reschke of Staten Island, New York, writes us,—"I am forced to write you this letter. I have been using your Coto Transformers in quite a number of sets and find them superior to any other transformer regardless of price. The results I get I cannot equal with other audio transformers, clear and plenty of amplification. Am using WD11, WD12 and U. V. 201. A tubes."



Type 4500

The 3 to 1 Ratio Audio Frequency Transformer Is Best for All Stages

Again the simple, economical, easy way proves best in radio. For an amplification unit that will be a real sweet singer without shielding, jockeying or fuss, Coto Specials in all stages is your sure and money saving bet. Great for reflex circuits too. Low price (\$2.50) is their least recommendation. Jobbers are ordering in thousand lots.

The Original Honeycomb Wound Coils

Years of factory experience in quantity production account for combined extra quality and low price.



\$1662⁰⁰ Earned IN ONE SEASON

A NEW BUSINESS—BIG BUSINESS

A Business to Enthuse Over—

The "Ideal" Lawn Mower Sharpener

A wonderful invention that sharpens lawn mowers scientifically—quickly—perfectly; does the work as nothing else can.

Fred C. Milkert of Melrose Park, Ill., writes:

"The Ideal Lawnmower Grinder put me in business, starting in the basement of my home and forcing me now for the third time to move into bigger quarters. Today the dream of my life—a shop of my own—is realized. With a machine like yours and a little hustle any man can have a business of his own and be independent."

You Start Now No town is too small. Lawn mowers are dull—owner doesn't know where to get them sharpened. Mowing the lawn dreaded because of dull or improperly sharpened mower. Lawn mowing is healthful, invigorating and pleasant when Mower is "Ideally" sharpened. You do the work scientifically—you are in big demand.

W. F. Keadt, 1476 Main St., Buffalo, writes:
I sharpened 994 lawn mowers last season, and the receipts were \$1662 which is not bad for a side line



Lawn Mowers Sharpened to Razor Edge—

People glad—owners delight in mowing lawn with mower sharpened on an "Ideal." Mower runs light—click-click-click and the grass is cut. Build permanent business for yourself. Start now!

Write Today

Get our proposition Free
We have detailed illustrated book to send you.
Write today for our proposition.

USE THIS — MAIL IT TODAY
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Please mail at once details of your complete proposition.

Name

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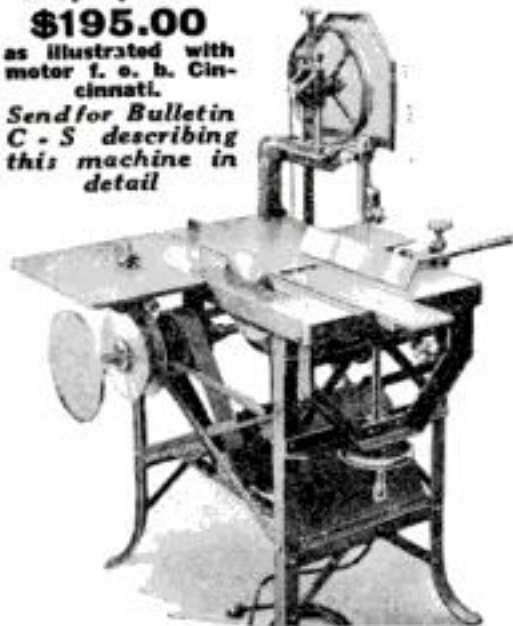
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Parks "Cabinet Shop Special"

\$195.00

as illustrated with motor f. o. b. Cincinnati.

Send for Bulletin C-5 describing this machine in detail



The Biggest Little Woodworker Ever Built!

You'll want this sensational Parks combination woodworker right away for your shop—includes 8-inch rip and cross-cut saw, 4-inch jointer, band-saw, borer, shaper, sander, and universal motor. Only \$195 complete! Lathe attachment only \$15 extra. First-class Parks angle-steel construction, all joints electric-welded. Steel table-top. The newest thing in small shop equipment. Guaranteed 10 years.

The Parks Ball Bearing Machine Company
1547 Knowlton St., Cincinnati, O.
Canadian Factory: 200 Notre Dame East, Montreal, Can.

PARKS

WOODWORKING MACHINES

MAN IS ON THE BRINK OF A MIGHTY DISCOVERY

Sir Oliver Lodge says he hopes this discovery will not become generally known until mankind has sufficient wisdom to handle the power that it will loosen. But scientists have already tapped this source of power! Not yet harnessed perhaps but yet plain enough that ANY AVERAGE PERSON can to a large extent demonstrate it in daily life.

With the use of this ENERGY you can accomplish anything humanly possible. This FACT has been proven by the actual experience of thousands of people during the last twelve months in whose hands we freely placed this amazing discovery. You not only "get the idea" but it applies itself to your affairs within a few days.

Nothing Impossible

Literally thousands of people changed their lives almost overnight by this revelation. With this secret Col. Adams of Salt Lake City made over \$4,000 in a few days.

Unless this power will immediately and practically WORK for you, unless you can demonstrate it as clearly as a child demonstrates electricity by turning on the electric light, IT IS WORTH NOTHING TO YOU. For all men are not equal. Doubt, fear, suspicion, distrust, irresolution are chains that make slaves of many.

Five Days' Free Trial

Simply send your name, postcard will do, we will mail you postpaid, CLEAR, POSITIVE, SIMPLE instructions that you can begin applying IN A VERY FEW HOURS. You have five days to study and examine it without cost. If it proves valuable in obtaining concrete results we leave it to you to pay us within 5 days what in your judgment it is actually worth to you or what you honestly can afford to pay. If you think it is worth nothing, pay nothing, simply return it. This plan seems strange and unusual. But the power and secret are ALSO strange and unusual. You WRONG only yourself if you delay.

The CARNAGEY INSTITUTE
H. C. CARNAGEY, President

504 Hayes Bldg. Dept. 605 Kansas City, Mo.

Home Workshop Chemistry

(Continued from page 126)

months. A mold was shaped in it by scratching it gently with a knife. Metal cast in this way is much easier to handle than if it is in lumps or flat pieces.

The same low melting alloy can be used to solder the connections of a radio coil, the heat being applied by a match or a small alcohol lamp or blowpipe. The solder will melt quickly and run freely under the heat of a match.

Soft pewter and other low melting metals are easily soldered with a soft solder consisting of 5 parts (by weight) of bismuth, 3 of tin, and 2 of lead. It melts at approximately 212° F. Care must be taken in soldering easily fusible metals together to be sure that the solder melts at a lower temperature than the metals to be united.

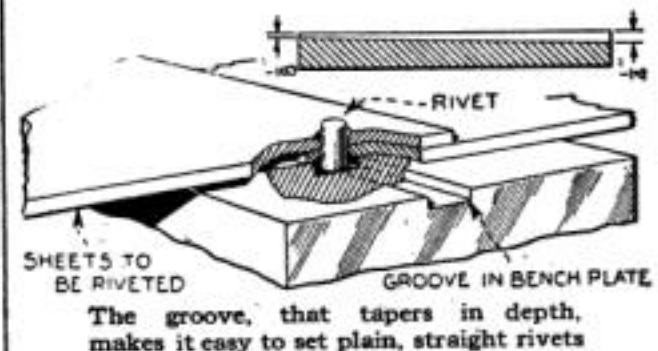
Fluxes are used with most solders in order to absorb oxygen and prevent the metals from forming oxides. Calcined borax, which is a neutral salt, has the property of dissolving the oxides formed while soldering. Another neutral soldering flux often employed with success is powdered rosin or tallow, although beeswax is better than the last-mentioned substance. If none of these substances or no commercial flux is at hand, a wax candle will often serve with fair success.

Aluminum is most difficult to solder. It takes up oxygen too readily when heated, and also gives up its heat too quickly. The presence of phosphorus in a solder prevents oxygen absorption. An aluminum solder can, therefore, be made of 2 parts of silver, 9 parts of aluminum phosphide, 39 parts of tin, and 50 parts of zinc. This solder requires no flux.

IN CONNECTION with this article on solders and fluxes, read Mr. Laraby's "Hints on Soldering," on page 134.

Groove in Bench Plate Aids in Setting Rivets Neatly

TO RIVET two plates or sheets together, when using plain rivet made for the occasion out of straight round steel is often a troublesome job. One side will have a full head, while the other side is apt to be shrimpy. A bench plate with a groove planed across its rough side will solve this difficulty. The groove



should be planed with a taper, as shown, $\frac{1}{8}$ in. deep at the shallow end and $\frac{1}{4}$ in. at the deep end.

When using the grooved plate, slide the sheets with the inserted rivet back and forth until the proper projection on both sides has been obtained and then rivet the upper side. Next, turn the joint over and the other end of the rivet will be projecting sufficiently to head up well.

Making a Wooden Holder for a Small Cabinet Scraper

FOR the finishing of small hardwood pieces, this plane-like scraper is easier to use than the ordinary flat steel cabinet scraper. It is easy to make, too. As the necessary steel, wood, and screws were found in the shop, the total cost for the one illustrated was five cents, spent for the knob at a five-and-ten-cent store.

Cut off a 10-in. length of 2 by 4 in. wood, and, 5½ in. from one end, make a notch very slightly more than halfway through the block. The sides of this notch should form an angle of about 90 degrees. This angle is not important, but



The scraper in use and the few parts that are necessary for making the tool

the angle that the back surface makes with the block, is; it should be within a degree or two of 10 degrees from the perpendicular.

If an old hand scraper is available, the blade can be cut from it, 4 in. long and as wide as the rear surface of the notch, plus ⅛ in. Two elongated holes are made in the steel by drilling two pairs of holes ¼ in. apart and cutting out the intermediate pieces with a chisel. The blade then can be set after the cutting edge has been worn down by sharpening. Round-head screws hold it in place.

Should this type of steel not be at hand, excellent material is obtained from an old kitchen knife blade of sufficient size or even the bit of a small plane.

The front-hand grip is a wooden knob attached by a long wood screw, and the rear grip is shaped from a block of white pine 1 in. thick. It is held by long screws through the top.—DALE R. VAN HORN.

Fixed Radio Condensers

EFFICIENT transmitting and receiving condensers for radio work can be made from old photographic plates.

The emulsion is first washed from the plates with hot water and the surfaces are then rubbed down with carborundum cloth, which takes off the gloss and leaves something akin to a frosted surface. The same result can be accomplished by exposing the plates to the fumes of hydrofluoric acid.

The glass is coated with ordinary aluminum paint and connections are made with small tinfoil strips sandwiched between the plates.—CARTER FISKE.



10 Shaves
FREE

See Coupon

My Life Work

The finest Shaving Cream you will ever know

By V. K. Cassady, Chief Chemist

GENTLEMEN:

I have devoted my life to soap chemistry. We have here developed some of the greatest soaps created. One of them—Palmolive—is the leading toilet soap of the world.

Our greatest ambition for years has been to perfect the supreme Shaving Cream. And we have done that, beyond question. Millions of men now concede it.

1,000 men consulted

Our first step was to ask 1,000 men what they most desired in a Shaving Cream. All of them agreed on four things.

But one requirement, and the greatest of all, is something no man mentioned. They were not scientists. They did not know the prime requirement in a shaving soap. That is, strong bubbles which support the hairs for cutting.

We made 130 tests

We made up 130 formulas which we discarded. Each was better than the one before. But none, in our opinion, reached the utmost in a Shaving Cream.

Then we attained, by many times over, the best Shaving Cream in existence. Someone may make a better one, but not much better. Today Palmolive Shaving Cream is monarch in its field. It is winning men by the millions, as they try it.

Don't change from the cream you like now until you see what Palmolive Shaving Cream does. But make this test. You owe it to yourself and to us. Try ten shaves, and let the results show if we have excelled the rest.

Excels in 5 ways

It multiplies itself in lather 250 times, so one-half gram suffices for a shave.

It softens the beard in one minute. No hot towels, no finger rubbing.

It maintains its creamy

fullness for ten minutes on the face.

Super-strong bubbles support the hairs for cutting.

The palm and olive oil blend acts as a lotion, leaving fine after-effects.

2304

PALMOLIVE SHAVING CREAM

Follow with Palmolive After Shaving Talc—
An invisible way to that well-groomed look

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10 SHAVES FREE

Simply insert your name and address
and mail to

THE PALMOLIVE COMPANY
Dept. B-623, 360 N. Michigan Ave., Chicago, Ill.

Science Says Use Nu-Gas To Cook and Heat

Up-to-date homes being built without coal bins because there's a better, cleaner, easier way to cook, bake and heat, by burning free air.

"Don't buy coal at present price," says a Domestic Science Expert. Don't buy it at any price. You can get far better results by burning free air and oil in the way science has recently discovered. The government does it, the big ships do it; factories do it; and new homes are being built without coal bins or wood-sheds because their owners have adopted the new, clean, dustless, dirtless, laborless device which fits in any stove.

Oil and Free Air Make Wonder Heat

Science has shown that one part of coal oil (kerosene) the cheapest of fuels, can be mixed with twenty parts of air (by a remarkable burner) and the result is a wonderful heating and cooking gas. Cheaper than city gas. No fires to build. Heats at twist of the wrist. Heats largest rooms in a few moments on coldest morning. Heats oven evenly for baking. No dirt, smell or soot. Saves work, saves furniture, saves health. And a new way has been found to cut useless parts, so that, of all burners, the NU-HEAT (the latest one) is the best and lower in price. In stalled in a jiffy in your present range, heater, furnace—then you are no longer a slave to coal and wood and the expense, labor and

AGENTS

Make \$50 to \$200 a week. Fulltime or spare time. Personal cooperation. Write quick for exclusive territory and free sample case offer.

dirt they bring. Absolutely safe. Sent on 30 days free trial. Amazing ironclad guarantee. Free Book About Remarkable Way to Burn Air. Learn how to cut housework in half. Learn to save by having all the heat you want but only when you need it. Learn cheap way to have the warmest, cleanest, cosiest home in town. Just say "send Nu-Heat information Free." Mention if you have heater, range or furnace. No obligation to you whatever.

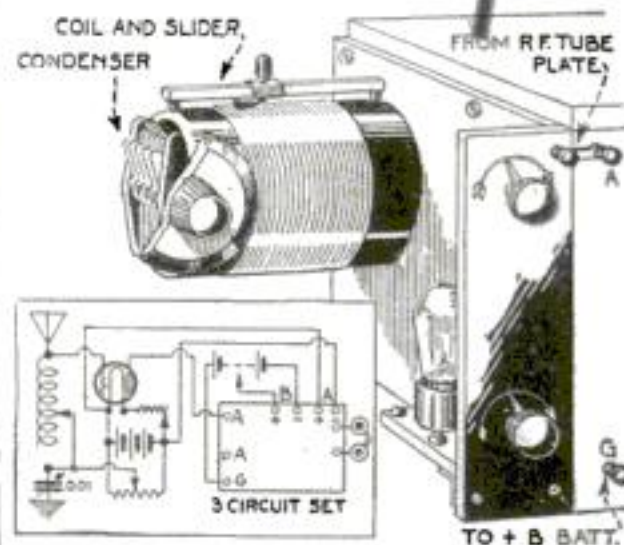


Wade Hill Manufacturing Co.
Dept. C-41, St. Louis, Mo.

Adding Tuned Radio-Frequency to a Triple-Circuit Receiver

TO ADD a stage of radio-frequency to an ordinary three-circuit receiver is a simple matter if the method illustrated is followed. The unit is fastened directly to the end of the cabinet without marring it or necessitating any change in the wiring of the radio set.

Even in midsummer, when reception generally was poor, I was able to hear Omaha, Neb., Dayton, Ohio, Detroit, Mich., and Dallas, Tex., on my set in Baltimore, Md. These stations came in clearly on my homemade loudspeaker,



Circuit of one-tube radio-frequency amplifier and method of mounting parts

four tubes being used. Without the radio-frequency amplification the best I could do was Atlanta, Ga.

Either make a tuning unit with 60 turns of No. 22 enamel-covered wire on a tube $3\frac{1}{2}$ in. in diameter and 4 in. long, as shown, or obtain an old-fashioned single-circuit tuner. Fasten a 43-plate variable condenser at one end of the tube and then follow the illustration and wiring diagram in completing the unit.

The potentiometer is 300 or 400 ohms and the rheostat should suit the type of tube used. For local reception and whenever you do not wish to use the radio-frequency unit, only the aerial and ground connections need be changed and the plus B battery line disconnected from the radio frequency tube. The unit is not adapted to a receiving set of the single-circuit type.—JOHN A. MAHON.

Two Screweyes Serve in Place of a Hasp and Staple

IN ORDER to padlock a door that opens away from the side on which the padlock is to be used, it is often a problem to arrange the hasp and staple so that they cannot be removed too easily. A good method is to place two $\frac{1}{2}$ -in.



screweyes, as shown, one in the door and the other in the door casing. When the lock is in place, it is practically impossible to remove it without the key, or by cutting off one of the staples with a hacksaw.—H. L. WHEELER.



Charge Your Radio or Auto Battery at Home Overnight for a Nickel

with the

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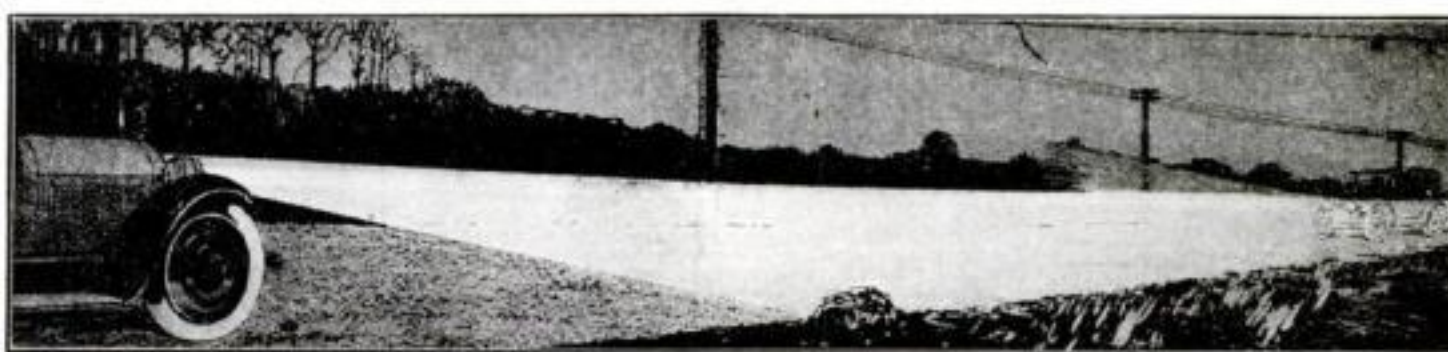


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The Detroit Safety Headlight Devices absolutely solve the greatest menace to auto-mobiling—the headlight glare. This is a new, simple device and fits any model of any car. Installed easily and quickly by anyone. Used with low priced plain glass lens. It

adds style and dignity to any car. It absolutely concentrates the light down on the road, not up in others' eyes. Drive with all the courtesy of the road with bright lights on. The glare is positively eliminated. Will last a lifetime. Will not rust, corrode or deteriorate. Meets every legal requirement. They are the best headlight devices made and stand any test.



PATENTED

Detroit Safety Headlight Devices Sell On Sight

They sell on sight—a demonstration sells anyone. Easily demonstrated in store, home or on car. Sold on 30 day trial—never taken out. Appeals to fairness—no one wants to drive others to death in ditch. Owners urge others to buy. See illustrations as to installation and effect.

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Offices: 1217 Book Bldg., Dept. 43

Detroit, Mich., U. S. A.

FREE—One Set Free Coupon

Motor City Syndicate
Offices: 1217 Book Bldg., Dept. 43
Detroit, Mich.

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Fill in both for \$2.00 offer.

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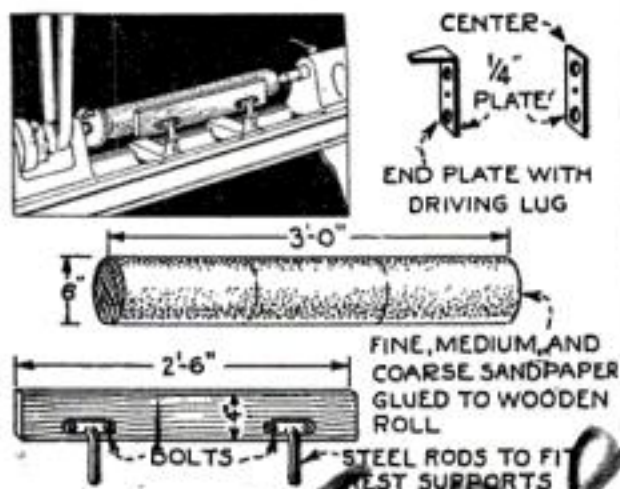
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Sanding Roll Is Useful Addition to Wood-Turning Lathe

THIS sanding roll has been used for a considerable time on a 6-ft. lathe for finishing woodwork, including moldings and house trim. The body of the roll, which is made of white pine or other wood, has two plates, one with a plain center and the other with a driving lug. To



A wooden roll covered with sandpaper is placed in the lathe for finishing work rapidly.

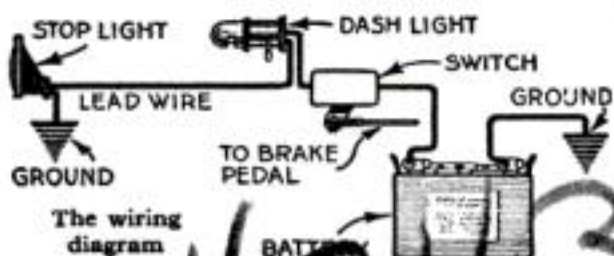
insure a true surface, the drum is turned after the plates are affixed. On the drum are glued three grades of sandpaper—coarse, medium, and fine.

In connection with the sanding roll, a long double steady rest is used. This is made by mounting a piece of oak edge-wise on two steady rest supports, as shown. The only need is the occasional renewal of the sandpaper.

Using Dash Light as Telltale for Auto-Stop Signal

WHEN the stop light on an auto fails to operate, there is generally no way that the driver can tell. If, however, this lamp and the dash light are wired in series, neither will operate if one is out of order.

An advantage of this plan is that when touring in the country, where the stop



signal is not used often, the connection can be broken by merely turning off the dash light switch. This saves the battery appreciably. The bulbs in both dash and signal lights should be the same candle-power. Since they operate in series, two bulbs designed for 3-volt circuits make a satisfactory unit for a 6-volt system.—GLEN F. STILLWELL, Collinsville, Ill.

Aluminum Runningboard Plates Cover Worn Floorboards

MANY used cars show more wear on the front floorboard than anywhere else because of the constant "digging in" of the driver's heels. Two low-priced aluminum runningboard plates will cover these worn spots and make an improvement well worth the small outlay of money and time necessary.—R. C. T.

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Keeping the Home Shipshape

How to do the odd jobs that save time, temper, and money



Soldering Hints

Countless odd repairs can be made with a soldering copper. Gutters and downspouts can be repaired, pans and kitchenware patched, broken metal parts fastened together, and even jewelry mended. For electrical wiring and radio work, of course, a knowledge of how to solder thoroughly and quickly is very essential.

For my own use I have two coppers, one weighing about 1/2 lb. for ordinary work, and a heavier one for soldering seams and larger work. Such coppers may be bought at any hardware store, but if one can obtain a piece of copper about 1 1/2 in. in diameter and 3 in. long, it is very easy to make a soldering copper. Simply bore a 3/8-in. hole across the copper, about 3/4 in. from the end, and bend a 3/8-in. iron rod, about 14 in. long, through the hole to hold the copper firmly. A wooden handle should then be added and the point of the copper tapered bluntly.

The copper can be heated in a gas-stove, by means of a blowtorch, or with any convenient source of heat. Let the most intense part of the flame heat the body of the copper, so as to lessen the danger of burning off the tinning on the point. With an electric soldering copper, the heating problem is, of course, taken care of automatically.

If the point has not been previously tinned, the first thing to do is to give it a coating of tin, which really means a

coating of solder. This is done by brightening the point with emery paper, applying flux in the form of rosin, acid or soldering paste, and melting solder over the surface. Then rub the copper quickly on a cloth until the point looks like bright tin. If the copper is ever greatly overheated, the tin will be burned off, and it will have to be retinned.

The first essential in soldering anything is to clean the parts. If the metal is thoroughly cleaned with emery cloth, file, and scraper, if the iron is hot, if a good flux is used, and if the parts are held so that they cannot move in relation to each other while the solder is being applied, there is no difficulty in making any ordinary soldered joint.

In soldering leaking pots and pans, apply the solder on the inside. If the hole is too large to fill with solder alone, either plug it with a tiny wad of steel

wool or apply a tin patch.

A step in advance of plain soldering is known as "sweating." To make a sweated joint, clean the parts, warm them a little and apply solder and flux till the surface of each is covered with a coating of clean solder. While the solder is still molten, wipe off as much as possible with a rag. This leaves the surfaces covered with a very thin plating of solder. Then bring the joint together and clamp firmly, apply the soldering copper to the joint and hold it until the solder seeps through the other side. Let the parts cool naturally. This makes the

(Continued on page 135)



Many repairs in the home can be made with a soldering copper

There Is Still Time to Enter Prize Contest for Best Shipshape Home Ideas

AS THIS issue of POPULAR SCIENCE MONTHLY goes to its regular subscribers and is placed on the newsstands about February 10, there is still time for a good many readers to enter the Shipshape Home Prize Contest announced last month. Letters must be in the office by February 20.

The subject of the contest is: "How I Keep My Home Shipshape." For the best letters containing practical, novel, and ingenious ideas on this subject, POPULAR SCIENCE MONTHLY will give a first prize of \$25, a second prize of \$15, and a third prize of \$10, and will purchase at space rates as many other contributions as are available.

Don't simply catalog a number of odd jobs; pick out one or two of your own ideas that have been particularly successful in reducing the upkeep cost of your home.

Keep your letter short — not more than 400 words. Inclose photographs or sketches, if possible, to illustrate ideas.

The winning letters will appear in the June issue. The contest will be judged by the Board of Editors and their decision will be final. Unavailable letters will be returned if accompanied by stamped and self-addressed envelope.

Address Shipshape Home Editor, POPULAR SCIENCE MONTHLY, 225 West 39th St., New York.

The Shipshape Home

(Continued from page 134)

strongest possible kind of soldered joint.

For hardware use hard solder, but for use in connection with jewelry and soft metals, have on hand a piece of soft solder. Soft solder melts at a lower temperature than hard solder. In every case it is necessary to use a solder that melts at a lower temperature than the metal to be soldered. It is not advisable to use acid when soldering tin; use a paste or rosin. Always wash the article thoroughly after soldering so that the soldering won't deteriorate or, as we say in the shop, "rot."

I have often seen amateurs use a soldering copper with a long-drawn-out point, evidently with the idea that it would do neater work. This is a mistake, in my estimation, as such a point will not hold the heat, and unless the work is of such a nature that a blunt point cannot be used, the blunter it is, the better.

Solder will not flow into a joint unless the metal is as hot as the melted solder. It can be heated by passing the copper over the surfaces a number of times after the solder has been applied to the joint opening.

When soldered joints are made outdoors, such as in connection with a radio aerial, it is advisable to paint the soldered parts, in order to check the crystallization of the solder. Thick asphaltum paint is easily obtainable and excellent for this purpose.—HENRY S. LARABY.

Stopping Small Leaks

HOT-WATER boilers used in connection with furnaces or gas heaters, sometimes leak at the riveted seam. Calking or patching with the usual repair plugs does not repair these leaks very successfully because of the uneven surface.

An easy method of repairing this type of leak is to place a large handful of bran, such as is used for horse feed, into either the top of the hot-water tank or the expansion tank of the hot-water radiator heating system. The bran is so glutinous that it lodges in any small openings in the system and seals them, provided they are not too wide. Such repairs are often as enduring as the remainder of the plumbing work.

After placing the bran in the hot-water tank, it is advisable not to draw any water overnight, to give an opportunity for the leaks to close.—G. A. L.

Laying Linoleum

THE edges of inlaid linoleum, especially when new, sometimes curl up where two pieces are butted together. To prevent this and the resultant cracking of the edges, obtain waste curtain cloth, the left overs from window shades, or old discolored shades, and tear in strips about 5 in. wide. Beginning at one end of the seam, place the curtain fabric flat on the floor, with the crack between the two pieces of linoleum in the center, and spread a portion of glue along the top of the curtain strip and on the under side of the linoleum near the edge. After the

(Continued on page 136)



Imagine the Amazing Things They Could Tell You

If a cave man could come out of the distant past to tell you of his prehistoric life—if Columbus could sit in your library and describe his experiences—if Steinmetz and Darwin, Franklin and Pasteur, Archimedes and a host of others whose discoveries have marked epochs in the progress of science were there to talk to you—what amazing things they could tell you! What a fascinating evening you could spend listening to their stories!

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POPULAR SCIENCE MONTHLY

225 West 39th Street, New York City, N. Y.

The Shipshape Home

(Continued from page 135)

glue has dried a little, press the linoleum firmly down on the strip, first one side and then the other. Use flatirons or any other weights as the work progresses and be careful not to crack the linoleum. If possible, have the room thoroughly warm.

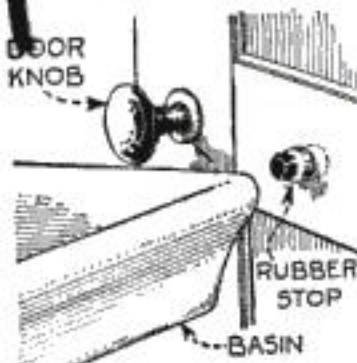
After the glue has dried hard, a good application of floor wax will fill up the crack and prevent dust and dirt from gathering in it.

This method was used in the writer's kitchen over two years ago, and the floor covering is perfectly flat. Irregular cracks can be treated in the same way, providing the carpet can be raised, and this sometimes will save a floor covering that seems about gone.—R. C. T.

Neat Door Stop

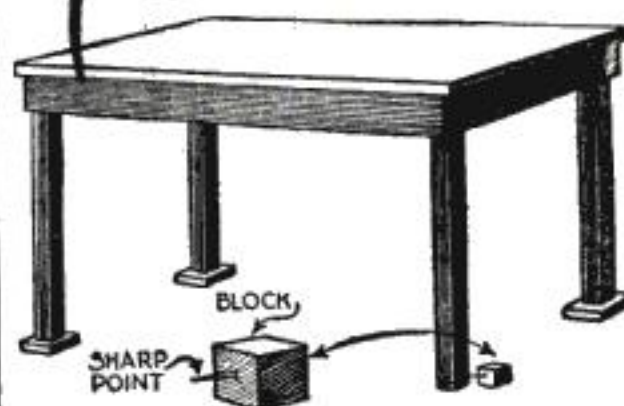
THE bathroom door in our home swung back against the lavatory in such a way that both door and basin would quickly be damaged. An ordinary door-stop could not be attached to the basin, and yet if it were placed on the door it would make a dangerous projection at a height to catch one's clothing or perhaps strike and injure some one.

The difficulty was solved by purchasing a rubber tip such as is used in a round metal socket on the foot of a crutch. A hole was bored in the door at the point where it struck against the basin and the rubber was glued in it. Now when the door swings back, only the rubber tip strikes the basin.—ED HENRY.



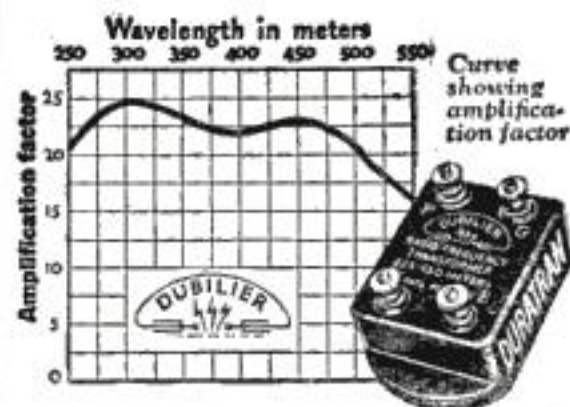
Adjusting Table Legs

To EVEN up the legs of a table is sometimes not an easy job. Try this plan and you will have no difficulty at all. First, find a level floor, then place the short leg on three blocks of even height. Get a fourth block and in it drive a needle



Either this simple scriber or dividers may be used to mark the long leg or other sharp point at the same height as the top of the other blocks, and mark around the long leg.

Given three long legs and one short one, place the table firmly and level, then drive your pointer into a block of wood at the base of the short leg and mark the other three with it.—E. A. McCANN.



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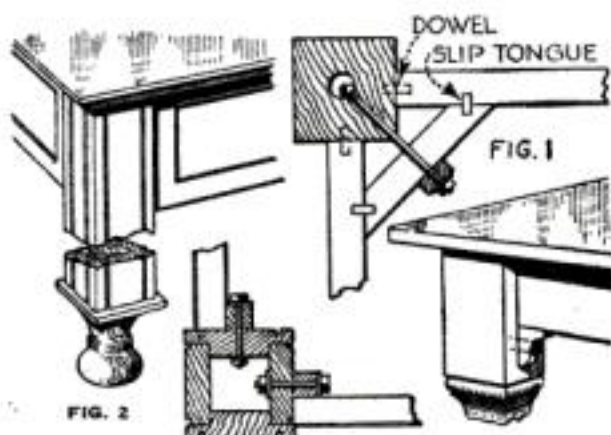
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Table Construction Simplified for the Amateur Woodworker

FROM the standpoint of the home worker, the two methods of table construction illustrated have several advantages. Neither requires the usual dowels or tenons, and both allow a table to be taken apart for storage or shipment.

In constructing the table as shown in Fig. 1, a hole should be bored in the top of the legs at the center to a depth equal to half the width of the table rails. This hole should be large enough to receive a bolthead and washer inserted through slot cut diagonally from the hole to the inside edge.

The corner piece, which is engaged by the bolt, is the same width as the rails and is cut on a miter at the ends. The slip tongues between the corner piece and the rails must be hard wood about 1/2 in. thick, cut the short way of the grain.



Neither of these tables requires elaborate joinery, as bolts hold the legs and rails

The short dowels are merely to locate the rails and to counteract any tendency they have to slip down; the small brackets serve a similar purpose, and one or the other may be omitted.

The dowels and slip tongues should be glued only at one end so that the table may be taken apart. The top may be fastened to the rails with screws, strips, or iron plates.

The legs of the table shown in Fig. 2 are made hollow. The grooves hide the joints and also conceal the heads of the nails used in fastening the parts together. In finishing, these grooves can be colored in the fashion now so popular.

Hardwood blocks are glued and screwed to the table rails, and either stair-rail or ordinary bolts are used to connect the parts. One bolt through each block at the top is sufficient; a heavy wood screw will serve for the bottom fastening.

With a top about 24 by 40 in. and with one large drawer, this table is suitable for use as a library table. With the drawer omitted and with narrower rails, it makes a neat table for occasional use in odd corners.—A. E. ELLING.

Tightening Auto-Spring Clips

BROKEN springs in passenger-cars and trucks are a common occurrence even when precautions to tighten the retaining clips may have been observed. The nuts to the spring clips may be pulled up fairly tight, yet the spring leaves may not be solidly together. The better method of tightening the spring clips is to do this when the car or truck is loaded, as it will be found the clips can be tightened considerably after the load is on the car.

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Framework Covered with Putty Forms Unique Floor Lamp

THAT an inexpensive and artistic floor lamp can be made mainly of putty seems absurd, yet the lamp illustrated was built in that way and it has been in use for more than six months. The putty on it is thoroughly dry and as yet it has not cracked nor fallen off.

The materials needed to make such a lamp are 7 pieces of wood, a lamp socket and plug, 10 ft. of lamp cord, a few nails, 25 cents' worth of shellac, 35 lbs. of putty, about 10 cents worth of gilt or paint, and a Chinese lantern.



The lampstand is covered with putty

The wood can be rescued from almost any trash heap. It does not matter whether it is surfaced or rough, although putty sticks best on the rough. The shellac makes the putty stick

to the wood better. Paint only a small surface at a time and apply the putty before the shellac dries.

If the putty is worked into the wood by hand, the dents left by the fingers give the lamp an odd finish. The putty will not harden for some time, but the lamp may be finished, gilded, painted, or touched up, as the maker sees fit, and used immediately, provided it is not roughly handled.—W. C. HAZEL, Hollywood, Calif.

Tool Racks Made from Old Cartridge Fuse Clips

DISCARDED cartridge fuse clips from old switchboards are to be found in the scrap box of almost every electrical repair shop. These may readily be made into excellent toolholders for the shop or used in the home to hold kitchen utensils.



'CARTRIDGE FUSE CLIP'
For holding tools

All that is necessary is to remove the two little nibs or stops that ordinarily retain the end of the fuse in place.

This can be done quickly by bending them back and forth with a pair of pliers and then filing off the rough spots where they break. The clips are then fastened to the wall or bench backboard with screws. The sides of each clip may be bent to fit the particular tool it is to hold.

A row of these clips forms a very neat rack for holding sets of bits, chisels, carving tools, and the like. They may be used equally well on the bench backboard or in a tool cabinet.—S. W. B.



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Using Your Car to Charge a Radio-Storage Battery

IN CHARGING the A battery of my radio set, I use my automobile generator. A single-pole double-throw switch is inserted in the charging circuit between the ammeter and the regular car battery, one lead going to the car battery and the other lead to any point in the car where the radio battery may be carried. To charge one or the other battery is then a simple matter of changing the switch. Care must be taken, however, that the car battery switch is closed when the radio battery is not in the circuit.

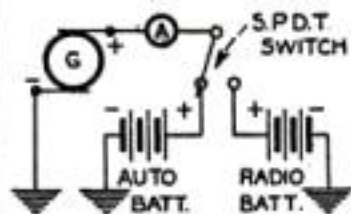


Diagram of battery-charging connections

If the brushes of the generator are set up to charge from 12 to 16 amperes, and if not a great deal of night driving is done, one will find that by this system both batteries will be kept charged and in good shape.

The generator must, of course, be of a 6-volt type, and both batteries of the kind used for autos. A battery made especially for radio work cannot be charged at so high a rate.—DALLAS BOUDEMAN, JR., Kalamazoo, Mich.

Drawing Ink Flows Freely in an Ordinary Fountain Pen

ALTHOUGH it is generally believed that India ink cannot be used in an ordinary fountain pen, I have been lettering and writing with drawing ink from the same fountain pen for more than a year. The secret lies in keeping the ink flowing. When not in use, the pen is placed in a corked test tube containing a little water. Don't change from regular writing fluid to India ink, however, without first giving the pen a thorough washing.—N. G. NEAR.



Walking on Auto Tubes

SHOES and arctics can be kept in repair, sometimes into the third year, by being re-soled with rubber from old auto tubes. It takes only a few minutes to resole a shoe; in fact, three pairs can be repaired in an hour at a cost for materials of only a few cents a pair.

The air-cured cement now sold is such an improvement on the cements of a few years ago that the rubber soles can be made to stick very well. A thin fabric or repair gum for bicycle tire repairing, which has both surfaces prepared to unite with air-cured cement, is used as an interlayer between the old tubing and the soles of the shoes. The other materials necessary are coarse sandpaper to roughen the rubber surface, a small wood rasp to roughen the leather, a pair of shears, a sharp knife, a light hammer, a file, and nippers for cutting nails.—E. A. WADSWORTH, Grand Forks, N. D.



Why Teeth Discolor

Tobacco, food, etc., stain the film

THE clouds on teeth lie in the film-coats. The remedy is to remove the film. Millions now daily combat the film, and the glistening teeth you see everywhere show what it means.

You must fight film

Film is that viscous coat you feel. It clings to teeth, and no ordinary tooth paste can effectively combat it.

Soon it becomes discolored by tobacco or by food, then forms a dingy coat. That is how teeth lose their beauty.

Film also holds food substance which ferments and forms acid. It holds the acid in contact with the teeth to cause decay. Germs breed by millions in it. They, with tartar, are the chief cause of pyorrhea.

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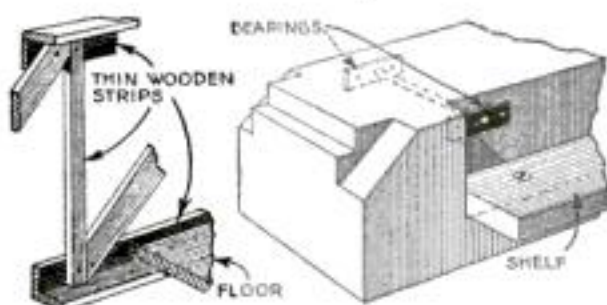
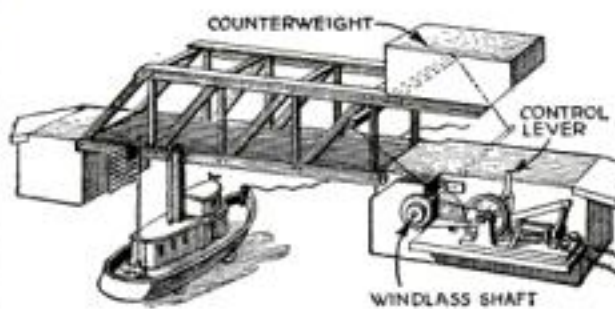
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A FEW strips of wood $\frac{1}{8}$ in. thick—cigar-box wood will do—several blocks, a thin board or two and a cheap toy motor are the only parts required to build this novel toy electric lift bridge. The span is 14 in. and the width of the roadway or bottom piece is $3\frac{1}{2}$ in. The cross-section of the bridge is $3\frac{1}{2}$ in. wide and $4\frac{1}{4}$ in. high over all. The propor-



The complete bridge and details of the main foundation pier and span members

tions can, however, be altered to suit any miniature railway system.

The main foundation pier is cut from a block 3 in. thick, $4\frac{1}{4}$ in. wide, and $9\frac{1}{2}$ in. long. A hole is drilled through it for the main shaft, which is $\frac{1}{8}$ in. in diameter, and small brass bearing blocks are fastened on each side, as shown. A shelf, in this case $2\frac{1}{4}$ by $7\frac{1}{2}$ in., is fastened to the block to hold the motor.

The other pier is cut from a block 3 by 4 by $3\frac{1}{2}$ in. The main members of the bridge span are strips $\frac{1}{8}$ by $\frac{3}{8}$ in. fastened with glue and escutcheon pins. The counterweight is a block $3\frac{1}{4}$ by $4\frac{1}{2}$ by 2 in.—DONALD W. CLARK.

Test Battery Restores Fading Signals of Vacuum Tube Set

HOW many fans remember the old-fashioned buzzer test for crystal sets? Not many perhaps, but I have found a way to test even the bulb set in a similar way.

Take an old and weak (the weaker, the better) dry cell, and connect the negative side of the battery with the ground terminal of the set. Connect the positive side of the battery in series with a push-button and the antenna binding post.

With the set I am using—a straight two-circuit loose-coupler hook-up with ungrounded secondary—this device accomplishes the following: (1) When signals fade, pushing the button brings them up to regular strength. (2) If, when the pushbutton is pressed, no noise is heard in the phones, it either indicates a loose wire or an incorrect connection. (3) Sometimes, when an inductance hum comes in too loud, pressing the button causes the noise to disappear. (4) It tests the condition of the regular batteries by the comparative loudness of the test signals.—WALTER LUHR, Secaucus, N. J.

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Perhaps even now you have splendid ideas for inventions but the only reason you have not developed them is because you doubt your own ability to invent. Or, like most persons, you believe that you were not born to be an inventor; that inventors are men who invent things as naturally as other people

work as bookkeepers, mechanics, doctors or farmers.

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Invention is not guesswork or blind luck—it is not a God-given faculty possessed by a few favored mortals. As a matter of fact inventors themselves say that invention is based upon exact laws which *anyone* can learn. It is merely a matter of first *seeing* something to be fixed and then of *thinking* of some principle which will fix it. That is all—that is *everything* to invention. Brought down to its plainest definition, invention is merely the science of "fixing things."

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Swinging Shelf in Garage Holds Tools for Engine Repairs

VALVE regrounding, decarbonizing and other auto-engine repair work can be speeded up surprisingly if a shelf bench is made for the home garage, as illustrated. The tools are arranged on this board in



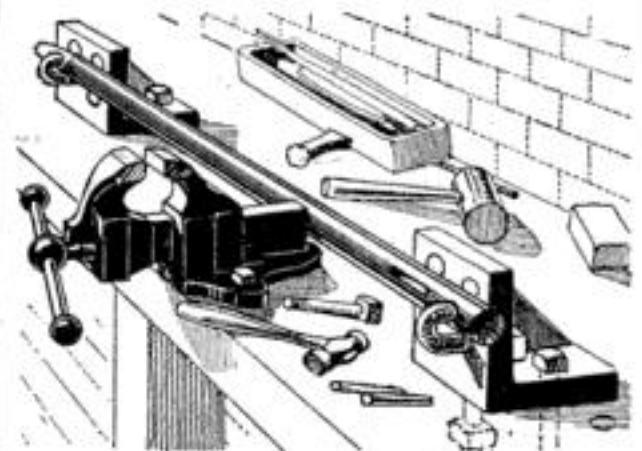
Tools for tuning up the engine are immediately available on this folding shelf

holders or strap pockets so that they are instantly available. The shelf is hung in the forward end of the garage, adjacent to or under a window if possible. The height when lowered is enough only to clear the radiator of the car.—G. L.

Vise Provides Pressure for Simple Bench-Straightening Fixture

IN STRAIGHTENING parts on the bench it is customary to use the vise to grip one end of the part and to pull or press the opposite end with the hands. Several trials are often required to rebend the part to its former straightness. An improvement on this method is the use of the straightening fixture illustrated. This is used mainly in automobile repair work but it is generally serviceable.

In the rear of the vise are two small angle plates bolted to the bench top. The



Held against two angle plates, the bent part is straightened by the vise ram

faces of these plates are drilled with holes for hook bolts, which are used to hold against turning the parts to be straightened.

The work is lined up and fastened so that the screw or ram of the vise will bear against the center of the bend. The controlled pressure of the vise screw makes it possible to use a straight edge or other means to test the work. Irregularly shaped parts, such as crankshafts, camshafts, connecting rods, and parts of an auto's steering mechanism, can be straightened advantageously in this way because the bench top provides a clear, flat surface for blocking and testing.

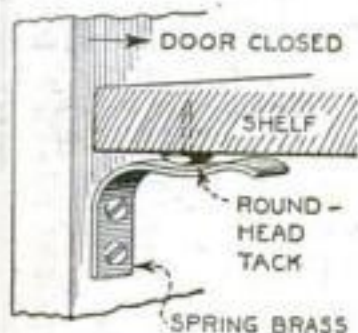
Simple Spring Catch Holds Cupboard Door Shut

CUPBOARD and closet doors frequently cause annoyance by refusing to stay shut unless equipped with a spring catch that is both dependable and strong. Such a catch may be made in a few moments' time out of a small 1/2-in.

wide strip of spring brass and a round-head tack.

The brass is bent as shown and fastened on the inner side of the door so that the curved end of the spring touches lightly the under side of the middle shelf.

The round-head tack is driven into the bottom side of the shelf in such a position that the spring will slide over it and snap into place. This holds the door closed, but still it can be opened readily.—S. W. B.



The catch engages a round-head tack

Rubber Cap for Screwdriver

ON MY hand screwdrivers I use a rubber cap, as shown, to eliminate friction in the palm of the hand. A small hole is drilled in the end of the handle and a rubber-head tack is driven in. Working the tack around a few times will make it turn freely.

This scheme makes a straight screwdriver work almost as well as a ratchet, besides providing a cushion for the palm of the hand.—W. T. M.



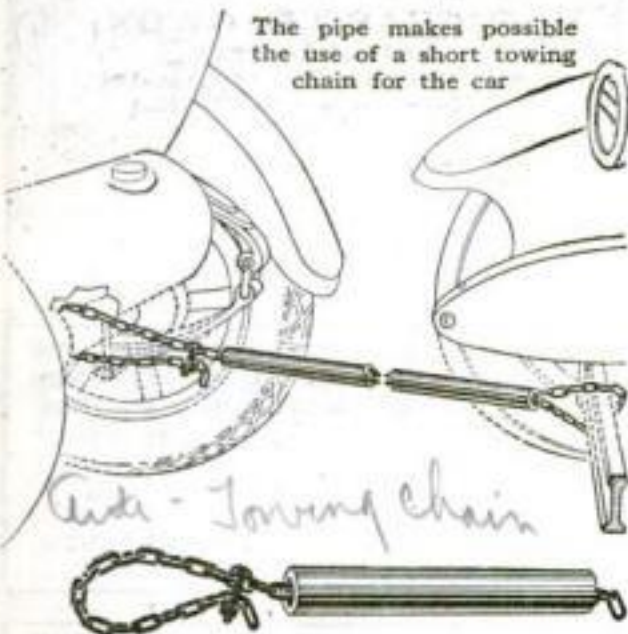
RUBBER CAP

Wrought-Iron Pipe Improves Emergency Towing Chain

WHEN a short chain is being used for towing a disabled car, it is advisable to run the chain through a pipe.

This method was devised for towing a car stranded in the country where the

The pipe makes possible the use of a short towing chain for the car



longest chain available was a trace chain. This was so short that the brakes were ineffectual, but by placing a section of wrought iron pipe, about 10 ft. long, over the chain, the tow of more than 20 miles was made without an accident.

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How to speak and write Masterly English

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Mr. Cody has specialized in English for the past twenty years. But instead of going along in the old way he has applied scientific principles to teaching the correct use of our language. He made tens of thousands of tests of his various devices before inventing his present method. In all his tests he found that the trouble with old methods is that points learned do not stick in the mind. In school you were asked to remember rules and if you forgot the rules you never could tell what was right and what was wrong. For many years Mr. Cody has studied the problem of creating instinctive habits of using good English. And as a result of his experience he evolved his wonderful new

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A patent was granted Mr. Cody on his unique device, and now he places it at your disposal. This invention is simple, fascinating, time-saving, and incomparably efficient. You do the lesson given on any page, then you see exactly how Mr. Cody himself would correct it. You mark your errors and check them in the first blank column. Next week you try that page again, on the second unmarked sheet, correct your errors, and check them in the second column. You see at a glance what you have learned and what you have failed to remember, until you have reached the 100% point in spelling, punctuation, grammar, and expression.

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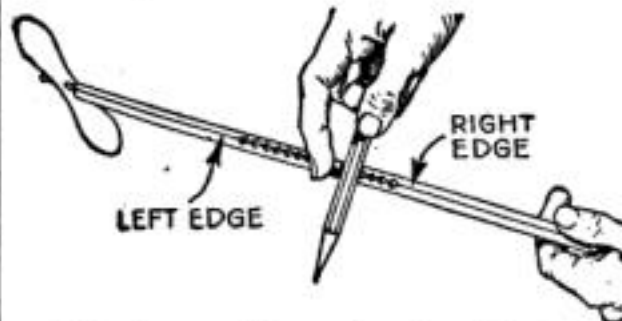
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Trick Toy Propeller Mysteriously Reverses Its Revolution

RUB the notched stick of this puzzling little toy and the propeller wheel will spin in one direction. Keep on rubbing and it will suddenly stop and begin to turn the other way—that is, if you know the secret of the toy.

The propeller itself is simply carved from a stick of soft wood three or four in. long. It is mounted by means of a small nail on the end of a thin square stick, preferably hard wood, twelve or



How the propeller revolves depends upon whether the left or right edge is touched

15 in. long. Along one edge of the stick a series of notches are cut, as shown.

To operate, hold the propeller stick horizontally by the extreme end and rub the notches with a pencil or other stick, at the same time pressing lightly with the forefinger against what is marked in the illustration as the left edge. To change the direction of revolution, lift the forefinger away from the left edge and press lightly against the right edge with the thumb. This can be done without noticeably altering the position of the hand or fingers, so that very few observers will see what has caused the propeller to change its direction.—
WALTER MARKOWSKI, Camden, N. J.

Shortening a Steel Wire Belt

STEEL wire belts—that is, belts consisting of a long coil of spring steel wire—are so widely used now that it is a good thing to know how to shorten or rejoin them.

Cut off the belt, when it is to be shortened, by forcing the blades of the wire cutters between the coils and snipping straight through. Insert a small screwdriver under the first loop (A) and pry it up until it can be seized with a small pair of pliers. Bring up the loop with the pliers until



Steps in forming the connecting loop

it is upright, and then twist it around so that it extends diametrically across the coil (B). The loop must be bent up at such a point that the end of the wire will allow the loop on the other end of the belt to hook in, yet make the opening no larger than necessary (C).

Steel wire belts do not work well unless they fit closely in the grooves of their pulleys. Put such a belt on a pulley designed for a round leather belt, and it will slip and be practically useless. In a pulley with sharply pitched flanges, it can wedge itself in firmly.

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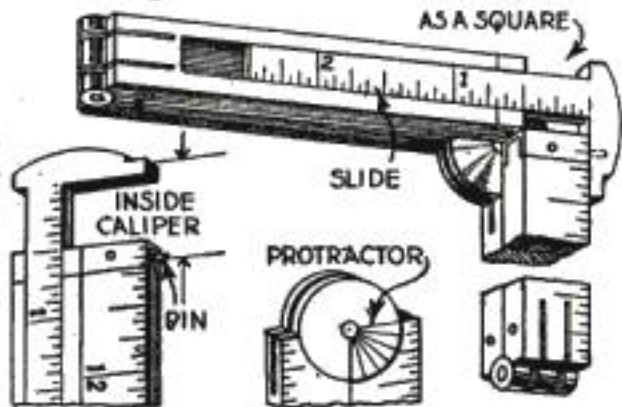


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How the rule is used as a square, protractor, and inside caliper

width and inserting a small pin, as shown. This allows the rule to be used as an inside caliper.

In addition, I have marked off the major angles on the principal hinge, and this enables me to measure angles within a fair degree of accuracy. By opening the rule at right angles, the caliper head serves as a guide in making a serviceable square, and the caliper portion can be removed and used when necessary as a depth gage.—E. J. MORRISSEY, West Allis, Wis.

Washers Used to Fix Uneven Legs on Movable Furniture

A PORTABLE workbench we were using about the garage became somewhat wobbly because one of the legs had shrunk until it was shorter than the others. To avoid the work of removing the rollers or casters from the other three legs and sawing them off, we simply placed a washer, as shown, above the roller on the short leg. This is the simplest possible way of making such an adjustment on furniture having casters and saves much trouble.—G. A.



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Neutrodyne Set

(Continued from page 73)

condensers, the two jacks, and the two rheostats. Then drill holes for the seven binding-posts (if you desire them on the front of panel). Also drill the proper holes for fastening the tube sockets and the rheostats and for fixing the panel to baseboard.

The holes used for fastening the variable condensers are the most important and should be located with the greatest possible accuracy. The purpose of mounting them at the 55-degree angle shown in Fig. 1 is to prevent interaction between the currents in the coils that are attached to the backs of the condensers. Deviation from the true angle by more than a degree



Front view of panel with tuning dials

is likely to result in objectionable oscillation. Fortunately the angle is independent of the distance from center to center of the coils.

Next, cut the sheet copper to size and drill clearance holes as indicated by the dotted lines in Fig. 1. This shield is not absolutely necessary for every receiver, but it always will be an improvement, since it does away with bothersome body-capacity effects. In some receivers that have come to the writer's attention, shielding of some kind was absolutely necessary, for the reason that the neutralizing condensers could not be adjusted to small enough capacity if the shield were absent—i.e., the receiver was over-neutralized, due to inherent capacities between condensers and coils of adjacent stages.

The shield then can be fastened to the panel. The tube sockets *D* and *E* will



Rear view of panel, showing three special neutrodyne tuning elements, called "neutroformers"

hold it securely at the bottom and several flat-head machine screws with nuts are sufficient to hold it at the top. Next, mount detector-tube socket *F* and amplifier-tube sockets *G* and *H*. The condensers and coils (neutroformers), *A*, *B*, and *C*, then should be fastened. Examination will show that each transformer has an outer coil about two inches in width and an inner coil about one half inch in width that is placed toward one end concentric with the outer.

The outer coil is provided with a tap about half an inch from the end where the primary or inner coil is placed. The complete units, *A*, *B*, and *C*, should be mounted so that the primary or inner windings are at the upper left (when viewed from front of panel). It is possible to mount the coils so that they all

(Continued on page 147)



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Neutrodyne Set*(Continued from page 146)*

slope the other way, but this necessitates longer connections.

After mounting the rheostats, jacks, and binding-posts as indicated in the sketch (P, Q, N, O, from 39 to 45 inclusive), the wiring may be commenced. The connections first described are those that carry relatively large radio-frequency currents or are at relatively high radio-frequency potentials. They should be as short as possible and at the same time be kept as far as possible from other wires.

Details of Wiring the Set

Referring to Fig. 1: From antenna binding-post 39 run a lead to point 1, a connection on the inner coil of unit A. From 2 run a lead to ground post 40. Then run leads from 3 to $\times PD$ (negative filament of tube D), and from 4 to GD. Connect shield at 38 with ground post 40. From PD proceed to 5; from 7 to $-FE$; from 8 to GE; from PE to 10; from 12 to $+FF$; from 13 to 19; from 20 to GF; from PF to 46; and from 46 to 27. (Note that condenser T may be placed to better advantage to the right of and under tube F.) With the exception of the leads to the neutralizing condensers J and K, this completes the first group of connections.

The second group includes the low-potential connections, that is, those at low radio-frequency potential. They include the connections that supply the tubes with the direct current and the connections of the audio-frequency stages. In this group the battery connections should be bunched and well insulated to prevent short circuits, while the audio-frequency transformer connections should be short and isolated as much as possible.

The negative filament bus wire begins at the ground connection 2-40 and connects successively $-FD$, $-FE$, $-FG$, $-FH$, and finally the 6-ohm rheostat Q at point 23. It should be noted that this wire does not connect with $-FF$ on the detector tube.

The positive filament bus starts at $+FD$, is joined to plus A battery, post 41, and then continues to $+FE$, $+FG$, and $+FH$ in order. A connection also is made to the detector-tube rheostat at 21. Connect also from negative A battery post 42 to $-FF$, to 44 (negative B battery post), to 47 and to rheostat at 24. This connection is termed the "negative battery lead."

How to Mount the Transformer

The positive B battery lead starts at 6, is connected with by-pass condenser R at 48, proceeds to point 11 on unit C and ends on jack O, point 28. A connection is made also from this bus with the proper post at 45. Connect 49 with negative battery lead. The positive detector B battery lead starts at 43 and proceeds to 25.

The next step is to mount the audio-frequency transformers in their proper relative positions on the baseboard. The connection 34 to positive B battery lead should be soldered first at the lead, with the end 34 free. This applies to connections 25 to 30, 26 to 31, 33 to negative battery lead, and 37 to 24. Points 25, 26,

(Continued on page 148)

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Neutrodyne Set

(Continued from page 147)

33, and 37 should be soldered after the panel is fixed to the baseboard.

There remain only the connections PG to 35, PH to 29, 36 to GH, 32 to GG and the connections with the neutralizing condensers, or "neutrodons." These condensers should be mounted as shown, making the connections 15 to GD, 16 to 9, 17 to GE, and 18 to 14. The condensers consist of two wires, one about one inch and the other about three inches long, which are inserted in the opposite ends of a glass or other insulating tube. The ends of the wires within this tube are separated by about half an inch.

Adjusting Capacity Values

A metal tube about three inches long is arranged to slide over the outside of the insulating tube. Moving this tube so that it covers the gap and finally a portion of both wires increases the capacity, while sliding it away from the gap decreases the capacity. If it is impossible to obtain sufficient capacity by using the two wires as terminals, greater values may be obtained by making connections between the tube and the short wire, or, finally, between the tube and the long wire.

The receiver now is ready to adjust. Connect the antenna with 39 (a fairly large aerial is best for adjusting purposes), the ground with 40, the plus A battery terminal with 41, the minus A battery with 42, the plus 22-volt terminal of the B battery with 43, the minus B battery terminal with 44, and the plus 90-volt terminal with 45. It is well to connect the A battery first and insert the tubes before connecting the B battery. If the tubes light, one can be reasonably sure that no error has been made that will result in burning out the filaments.

With regard to the tubes, UV-201-A or C-301-A should be used in all five sockets. A soft detector tube, such as the UV-200, may be used at F if desired; but if this is done, it will be better to substitute a six-ohm rheostat for the 30-ohm specified at P.

Tuning in the First Signals

To continue, set rheostats at the "off" position and insert the tubes. Bring the filaments up to normal brilliancy with the two rheostats and insert the telephone plug in detector jack P. A strong local station that operates on a low wave (from 300 to 360 meters) is preferred as one on which to make adjustments. Any strong signal will do, however. Station KDKA in Pittsburgh, for example, has sufficient signal strength in New York City.

Suppose you are in New York, and have selected KDKA as the station. Set dials B and C on 20 divisions and move antenna dial A back and forth from 0 divisions to 20. Probably the receiver will be in a very critical and unsatisfactory condition, but with a little care the desired station may be tuned in by adjusting all three dials, although it may be accompanied by all kinds of squeals and beat notes.

Then proceed as follows:

(Continued on page 149)

Neutrodyne Set

(Continued from page 148)

1. Remove tube *D* from its socket and place a piece of paper over one of the filament prongs (see Fig. 3). A good way to do this is to make a small hole in a piece of paper, put the prong through it, and double the paper back over the bottom. This holds the paper on when removing the tube.

2. Replace the tube, which now does not light up, and retune the dials if necessary. The signal now will be much weaker and the telephone plug should be shifted to the amplifier jack.

3. Adjust the neutralizing condenser *J* by sliding the metal tube until no signal, or at least the weakest possible signal, is obtained. This adjustment is very important and the experimenter should be sure that he actually has obtained a balance. One check is to see whether, when the tube is removed entirely and dial *A* is retuned, the signal again becomes loud, as it should. Also it should be possible when adjusting *J* to actually pass through the minimum and bring the signal up to moderate intensity by continuing the motion of the sliding tube. If this is done, the tube should be returned to the position of minimum signal before continuing.

4. Remove paper from prong of tube *D* and replace that tube.

5. Remove tube *E*, place paper on one of its filament prongs, and replace the tube in the socket. Again retune for maximum signal.

6. Repeat operations 3 and 4 with respect to condenser *K*, dial *B*, and tube *E*.

Receiver Should not Oscillate

The receiver now is completely adjusted and ready for use. It should not oscillate and should produce no beat notes or whistles with incoming signals. To receive other stations the best procedure is to move both dials *A*, *B*, and *C* a few divisions in the same direction. When all three circuits are in tune, a rushing sound will be heard. This noise is called "background," is unavoidable, and is noticeable only in very powerful amplifiers. It is due to atmospheric disturbances such as spark stations.

Continue to move all three dials, *B* and *C* first, then *A*, until the desired station is picked up. Once having heard a given transmitter, the dial settings may be recorded for future reference. Since the settings of dials *A* and *B* and *C* are independent, there will be only one combination of the three dial settings that is correct for any particular wave length.

On local stations the relatively strong signals may be amplified to such an extent as to overload the detector and amplifier tubes. This causes distortion. A remedy is to use a smaller antenna or, if this is not convenient, to detune one of the dials, preferably *A*, until a good quality tone is obtained.

In this article nothing has been said about the theory underlying the operation and adjustment of the neutrodyne receiver. If the reader is interested, he may refer to Proceedings of the Radio Club of America for March, 1923, also published in "Q S T" for April, 1923.

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Perils of Polar Flight

(Continued from page 33)

landing requires either a shed or a mooring-mast, or what is called a "three-point mooring." The latter means simply using several hundred men to pull the big ship down out of the sky. Thus, landing by dirigible would be out of the question if a new continent were discovered in the Polar Sea.

This brings us to the most important problem of all—that of rescue in case of disaster. No battle is properly planned that does not leave open a line of retreat. No arctic expedition is sanely prepared that does not provide a means of escape for its members who may get adrift.

A generation ago the United States Government sent out the Greely expedition to North Greenland and across to Ellesmere Land. It was the best-equipped arctic party that ever had been fitted out. Yet it ended in a tragedy that shocked the country.

The reason for that disaster lay in the fact that lines of retreat were not arranged for in proper detail. There was lack of information about arctic travel; confusion of instructions; misunderstanding of agreements. At Cape Sabine men died by starvation with plenty of food at hand. They didn't know how to get it. Thirty years later at the same Camp of Death, the writer and four Eskimos killed and cached two tons of walrus at the very same time of the year that the last three deaths in Greely's party occurred.

The Difficulties of Rescue

This is not criticism of that unfortunate expedition. The tragic facts are recalled simply to emphasize the almost insurmountable difficulties of this phase of arctic exploration.

Suppose, for example, that the three planes with which the explorer Amundsen is planning to make a polar flight, enter fog just past the Pole. With a poorly directed compass one pilot shifts to the right of his course. His radiator develops a leak, and he is forced down. On landing, he smashes his plane in rough ice. He has food for a month and clothing.

What plans could have been made to find and rescue him?

Briefly, it would take 20 of our best planes working for nearly a month from Point Barrow over 1000-mile lanes to cover properly all the area in which the unhappy man might be stranded. If he should have barely passed the Pole, we should have no plane that could be counted on to rescue him. He could not possibly make land with what equipment he might carry in his plane. Also, during the search, other aviators might get themselves in just such a jam as he would be in.

A dirigible might make a better search. But even a dirigible working from Point Barrow would have to have a mooring mast there. She would be held up by storms. Sleet might drive through her thin envelope and tear one or more of her balloonettes from which would escape the precious helium.

And don't forget that Point Barrow, the supposed base for such rescue work, cannot even be reached by ship to estab-

(Continued on page 151)

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Perils of Polar Flight

(Continued from page 150)

lish the base until early August! A fortnight or so later all chance of retreat by sea is closed.

Looks bad for any unlucky flier who crashes on the polar pack, doesn't it?

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Radio amateurs of the world have been asked by the American Radio Relay League to aid in tests and experiments to find an explanation for the mysterious invisible barriers that for months have screened from Alaska, the United States, and Canadian radio stations the signals sent out from the icebound ships of Amundsen and MacMillan.

We are not crying "Wolf" when we list these few of the problems of a polar flight. But it is a military maxim not to underestimate one's enemy.

There will be no such thing as the widely published "Dash for the Pole by Air." There would be no justification for such a stunt. Peary's work is indisputable. Amundsen's proposed flight from Spitzbergen to Alaska is part of a broad scheme of exploration of which we were informed long ago.

What we are chiefly after in the Polar Air Expedition is to clear the mystery of that great geographical vacuum north of Alaska. In it may be a tremendous body of land with untold riches of natural resources. Only recently five miles of platinum ore were found in the Ural Mountains that run to the Arctic Circle, and 32,000,000 tons of coal in Saskatchewan.

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Dwellers of the Sea and Shore, by William Crowder. An interesting addition to the Young People's Shelf of Science, edited by Dr. Edwin E. Slosson. Illustrated. The MacMillan Company.

The Complete Campsite Guide and Latest Highway Map of the United States, prepared by the United States Touring Information Bureau, Inc., with the co-operation of the Airway Section of the United States Army Air Service. A handbook of information for the motor tourist, including also an official directory of the airplane landing fields of the country.

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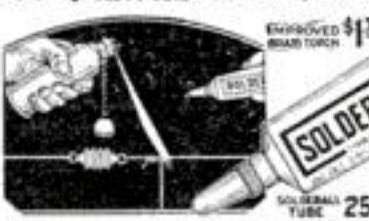
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Introducing Our New
SOLDERALL BLOW TORCH
of Heavy Solid Brass

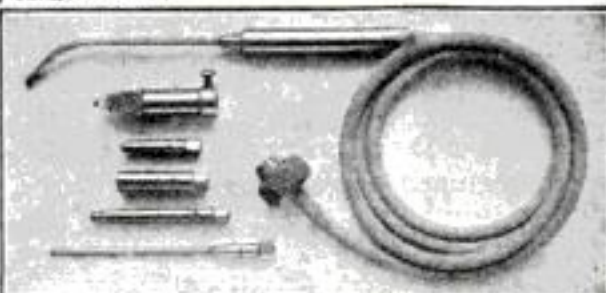
indispensable in the Home, Garage and to the Electrician. For soldering Radio, House Wiring, Jewelry, Ignition, Kitchen Utensils, etc.



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TORIT ACETYLENE TORCH No. 13

For radiator repairing, general soldering, light brazing, heating, battery repairing, etc. Produces instant hot flame, works rapidly. Furnished with 4 different tips and soldering copper, enabling you to do a wider range of work.



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A splendid use for discarded auto acetylene tanks. Many owners make the Torit No. 13 pay for itself in a single day. Torch with 4 different tips, soldering copper, 5 ft. tubing and connection for auto acetylene tank. . . . **\$7.50**

Order today from your jobber, or
St. Paul Welding & Mfg. Co., 164 W. 3rd St., St. Paul, Minn.

There's fun in making tobacco that brings such letters

The man who has found the right job, the right wife, and the right smoking tobacco has little reason to envy his fellows.

And some Edgeworth smokers write us as though the most important thing in life were the right tobacco.

We imagine that is because the right tobacco does make even the rightest job and the rightest wife seem a little bit righter.

That's why we enjoy making Edgeworth; and here's a letter from a seventeen-year Edgeworth smoker.

Larus & Bro. Co.,
Richmond, Va.
Gentlemen:

Norfolk, Va.

Permit me to toss my hat into the Edgeworth ring.

I have always admired the modest tone in which you touch on the merits of your tobacco, instead of advertising it as the best pipe smoke on earth—as, in fact, I believe it to be.

Seventeen years ago my father saw a friend filling his pipe from a tin of Edgeworth Slice and asked for several slices to bring home to me. It is worthy of note that the package was attractive enough in itself to excite my father's interest in the first place; but when I add that, so far as I am aware, he never used tobacco in any form during his entire life, it is still more remarkable.

Up to that time I was a member of the "Tried 'em All Club." Can I put any more steam behind this testimonial than to say that for seventeen years I haven't spent a dollar for any pipe tobacco other than Edgeworth. The Ready-Rubbed school of smokers enjoys my respect, but for me—give me Edgeworth Slice. Brother, it's a man's smoke and it stays with you!

Long may you make it and long may I smoke it.

One of your boosters,
K. F. Chapman,
1407 Omohundro Ave.

If you haven't tried Edgeworth, send us your name and address and we will immediately forward to you generous helpings of both Edgeworth Plug Slice and Ready-Rubbed, with our compliments.

For the free samples, address Larus & Brother Company, 59 South 21st Street, Richmond, Va. If you will also include the name and address of your tobacco dealer, it will make it easier for you to get Edgeworth regularly if you should like it.

To Retail Tobacco Merchants: If your jobber cannot supply you with Edgeworth, Larus & Brother Company will gladly send you prepaid by parcel post a one- or two-dozen carton of any size of Edgeworth Plug Slice or Ready-Rubbed for the same price you would pay the jobber.

Habits Make or Break Us

(Continued from page 39)

pulses flow more and more easily as time goes on. This process is true of good habits and bad habits alike. It requires some persistence to form a habit, but once the habit has been formed, it cuts so deep a groove that breaking it is something that only persons of exceptional will power succeed in doing. And a good habit is as difficult to break as a bad one.

Only a few weeks ago I astonished a New York business man by opposing his desire to bring about the retirement from business of his father, who is more than 80 years old. For 65 years this old gentleman has been rising at six in the morning, hurrying to his office, and working through the whole day as hard as his most ambitious young employee. Undoubtedly he has earned his retirement, but, as I told his son, to begin it probably would be fatal. The habits of a lifetime are not to be thrown aside so lightly.

There is nothing heroic about this old gentleman's devotion to business. He is in the grip of a habit as necessary to his well-being as food and sleep. Rest for him, as for others who are addicted to the praiseworthy habit of hard work, would be a dangerous experiment.

Life means activity, and when we cease to be active, the life force runs down in us. Few people ever have died of overwork, but the victims of inactivity are countless.

How to Direct Habits

It has been well said that if we acquire a sheaf of good habits, there will be little time or energy left in our lives for bad habits. And the acquiring of good habits is a matter merely of conscious direction of our mental grooves through our wills. In a previous article I described how the mind will not work except in response to a stimulus from without. No stimulus can be more potent than a conscious effort to direct our habits, a process that psychology has reduced to rule. The following maxims cover the ground thoroughly, and may be applied either in the formation of new habits or in breaking habits already formed:

Begin the task of acquiring or breaking a habit with all the strength and determination you possess.

Never relapse into your old habits, even when you are certain that the new habits are ingrained in you—have become second nature.

Respond instantly to every inward prompting toward actions that tend to aid the formation of the habits you seek to acquire.

Stimulate your habit of effort by performing every day at least one difficult task not connected with the habits you are forming.

As a single, all-embracing principle in the formation of habits, an eminent psychologist lays down this rule:

"Make automatic and habitual, as early as possible, as many useful actions as you can."

In "The Story of the Mind" next month, Doctor Walsh will explain the science of our emotions—what they are and how to use them for profit.



AGENTS 500% PROFIT
Genuine Gold Leaf Letters
GUARANTEED TO NEVER TARNISH



For store fronts, office windows, Bank windows, Office Doors, Panels, Board Signs, Trucks, Automobiles and Glass Signs of all kinds. Anyone can put them on and make money right from the start without previous experience.

All you have to do is to show your samples; the letters are very attractive and easy to sell. Letters costing 3 1/2 c sell for 25c. One agent says: "Your Letters are the best thing I have seen in years: I have made \$125.00 the first week and still going strong." Paul Clark says: "Smallest day \$28.70." H. Gilder made \$835.00 in six weeks.

\$60 to \$200 a Week

GENERAL AGENTS— It is easy to appoint sub-agents for this line. We pay you 20% cash commission on all orders we receive from local agents appointed by you anywhere. We allow you 50% discount on your own orders. You can sell to nearby trade or travel all over the country, as you please. Large demand for window lettering everywhere. Write today for free sample, full particulars and liberal offer to general agents.

Metallic Letter Co., 433-A N. Clark St., Chicago



13 WEEKS FOR 15 CENTS
You've heard your neighbor praise the Pathfinder, the wonderful weekly news and story magazine with over half a million subscribers. Unbiased digest of national and world affairs. Check full of just the kind of reading you want. Fun, fashions, question box, books, health—entertainment and instruction for all. Exciting serial and short stories. Send 15c (coin or stamp) today for this big \$1 paper 13 weeks. Money back if not satisfied. Sample copies free.
PATHFINDER, 591 Langdon Sta., Washington, D. C.

DON'T WEAR A TRUSS

BE COMFORTABLE—

Wear the Brooks Appliance, the modern scientific invention which gives rupture sufferers immediate relief. It has no obnoxious springs or pads. Automatic Air Cushions bind and draw together the broken parts. No salves or plasters. Durable. Cheap. Sent on trial to prove its worth. Beware of imitations. Look for trade-mark bearing portrait and signature of C. E. Brooks which appears on every Appliance. None other genuine. Full information and booklet sent free in plain, sealed envelope.
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If you're a radio enthusiast you're interested in long distance reception. And, no matter how loud and clear the nearby stations come in, the big thrill is realized only when you hear a station thousands of miles away.

Stromberg-Carlson

RADIO HEAD SETS

are built especially for long distance reception. They are equipped with Powerful Magnets which are necessary for sensitivity, sound volume and true tonal quality. Stromberg-Carlson Head Sets also have Layer Wound and Layer Insulated Coils—a construction which will stand up under the highest plate voltages that a radio tube will stand.

Send for our booklet *PS* which will tell you more about these Head Sets.

Stromberg-Carlson Tel. Mfg. Co.,
1062 University Avenue, Rochester, N. Y.



Agers \$12 a day

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New invention now makes ironing easy in every home. Ends hot stove drudgery. Cuts ironing time in half. Saves steps. Costs one cent for 3 hours use. No attachments. No cords. No tubes. Gives quick regulated heat. Guaranteed. Sells fast. Mrs. Wagner, Ohio, sold 24 in few hours spare time. Moyer, Pennsylvania, made \$164 in one week. You can do as well. Work all or s. are time. No experience needed. No capital. New plan. Simply take orders. We deliver and collect. Commissions paid same day you take orders. Send for exclusive territory and FREE OUTFIT OFFER. Write today. **THE AKRON LAMP CO., 443 Iron St., AKRON, OHIO**



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YOU can make \$15 to \$60 weekly in your spare time writing show cards. No canvassing or soliciting. We instruct you by our new simple Directograph System, supply you with work and pay you cash each week. Write today for full particulars and free booklet.

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Authorized Capital \$1,250,000.00
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We Pay \$7 a Day



Wonderful invention. The SERE-NOLA does more than machines costing 10 times its price. Orders taken by our agents for over a thousand a week—making from \$7 to \$21 a day. Big demand. Easily carried with you anywhere. Built in just like a suitcase. Fully guaranteed. Low price.

Easy to Take Orders

No collecting. Pay you every day. Get started at once. Territory given. Write for terms.

PERRY-LUDLOW CO., S-647, DAYTON, O.

Mechanics in the Wilds

(Continued from page 41)

doubtful junctions, heated in a primitive forge excavated from a dome-shaped white anthill and hammered on a tree-stump anvil.

After this adventure I joined the forces led by Sir Ernest Shackleton, and for the third time turned south.

I will venture to say that no expedition ever experienced and survived such privations of fantastic perils as beset us during the ensuing two years. For six weeks we forced a passage through ice-armored seas, eventually reaching latitude 77 south. At this point a terrific blizzard from the north compacted the icefloes around us. The open sea now was 1000 miles away and our little ship became gripped in a frigid embrace from which she never escaped.

For ten long, weary months we were mere human flotsam, insignificant and impotent against the overwhelming forces of nature. Our little vessel was fatally crushed and sank when 350 miles from the nearest land—a desolate rock off the antarctic coast. We resigned ourselves to floating on an ice-raft, hoping that some day we might be carried by the drift to the free rolling seas and then in our three small boats reach somewhere!

Where Mechanical Skill Counted

Never before did my fundamental mechanical training assert itself to such advantage. From metal scraps and odds and ends, I constructed our "blubber" stove and cooking utensils. I literally manufactured objects from needles to anchors with four tools—a file, chisel, hammer, and patience.

To conserve our slender supply of matches I made tiny seal-oil lamps from food tins, with wick floats that kept them alight at all times. Thus we always had sufficient fire to start our blubber stove, fashioned from a discarded ash bucket.

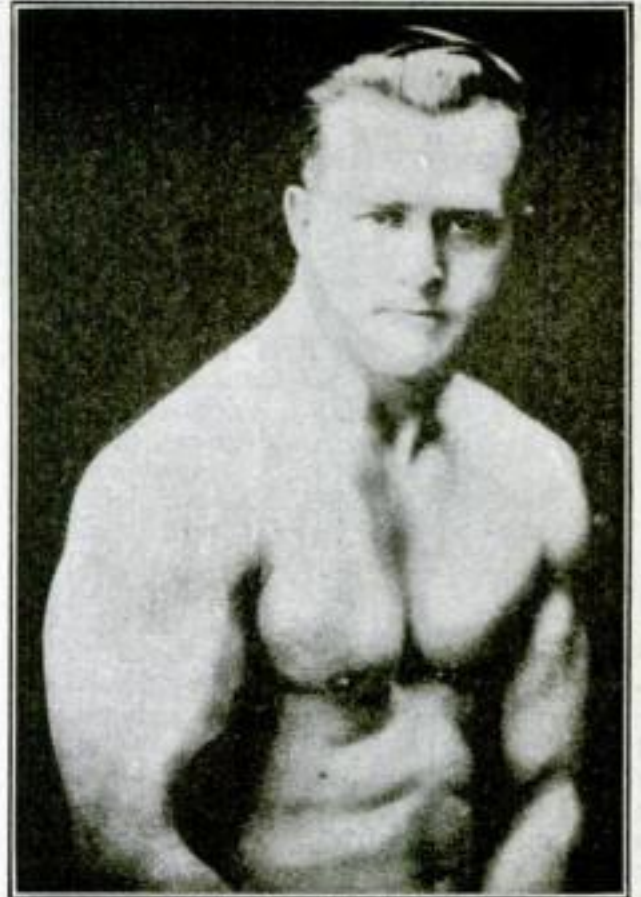
For days we drifted, dogged by starvation and aching cold. Then we reached the margin of the pack ice, where we launched three small boats, and headed for Elephant Island, 200 miles to the northward. Through heaving seas of scattered ice the small boats labored, until we safely reached our destination.

On a small, desolate rock ledge, at the foot of the unscalable cliffs of Elephant Island, we passed five months of cast-away life before relief came. We turned two boats upside down, heaped snow around them and with odds and ends of material fashioned a home. Here again my mechanical training proved invaluable.

During two years of exile in the antarctic, the great war had been raging. On returning to civilization I was offered the post of official war photographer to the entire Australian Commonwealth military forces.

Collectively, all these various experiences gave me a comprehensive insight into the leadership and meticulous details of expeditions. About three years ago I considered the time propitious to embark upon my own initiatives. The island of

(Continued on page 154)



EARLE E. LIEDERMAN
as he is today

If a Jelly Fish Could Slap a Rat in the Face

he would do it. But he can't. He has no arms. Neither does he have a backbone. How much worse off is a man who was given a good backbone and a pair of arms—and won't use them.

NO EXCUSE

We excuse the jelly fish. He never had anything to work on. But there is no excuse for a flabby, round shouldered and flat chested specimen of a man. You were given a perfect framework for a body. You were meant to rule the world, but there is hardly an animal alive which does not show better sense than you do.

CUT IT OUT FELLOWS

Brace up and be the man you were meant to be. Don't try to imitate a jelly fish. Get some pep into you and make a real *He* man out of yourself. Come on and let me help you. I'll shoot a thrill into you that will make your old spine quiver with excitement. I'll build up that chest, broaden those shoulders and give you the huge, muscular arms of an athlete. And that's not all. Your lungs will start pumping real oxygen into your blood, purifying your entire system. Those old cobwebs in your brain will disappear. Your eyes will radiate the life within you. You will have a spring to your step, and every move you make will show new life and energy.

IT'S NOT TOO LATE

I don't care what your present condition is. The weaker you are, the more noticeable the results. All you need is a framework and enough ambition left to say "I'm ready. Let's go!" I'm going to put one full inch on your arms in just 30 days. Yes, and two inches on your chest. But that's only a starter. Then watch 'em grow. I'll put pep into your old backbone and build up every muscle on your body so that your own friends won't know you. This is no idle talk, fellows. I don't promise these things—I guarantee them. Come on then and make me prove it. That's what I like.

Send for My New 64-Page Book "MUSCULAR DEVELOPMENT"
It Is Free

It contains forty-three full page photographs of myself and some of the many prize-winning pupils I have trained. Many of these are leaders in their business professions today. I have not only given them a body to be proud of, but made them better doctors, lawyers, merchants, etc. Some of these came to me as pitiful weaklings, imploring me to help them. Look them over now and you will marvel at their present physiques.

EARLE E. LIEDERMAN
Dept. 1303, 305 Broadway, New York City

EARLE E. LIEDERMAN
Dept. 1303, 305 Broadway, New York City

Dear Sir: I enclose herewith 10 cents, for which you are to send me without any obligation on my part whatever, a copy of your latest book, "Muscular Development."

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Street.....

City..... State.....
(Please write or print plainly)

What I Learned About Old Age



By
Byram C. Kelley, A.M., L.L.D.

CERTAIN new facts about old age, recently disclosed to me, constitute the most startling information I have ever received. I am 40 years old myself. I had begun to wonder if I would soon begin to "break"

—to lose my old-time pep and aggressiveness, my stamina and resistance to disease. I wondered if I would soon be subject to the class of ailments which seems so prevalent among men past 40. Then through a mutual friend, I made the acquaintance of a member of the American Association for the Advancement of Science, who has recently brought to light most interesting facts about the peculiar conditions common to men past middle age.

Why Many Men Are Old at 40

I had often wondered why so many men begin to lose their vigor and alertness when they are scarcely out of their 30's—yet others, at 60 and 70, seem to be in the prime of life. There must be some reason for this difference. And I found out exactly what this reason is.

65% Have Gland Trouble

I have learned that 65% of all men past a certain middle age have a disorder of a little gland, called the prostate. And prostate disorder is not only the direct cause of much distress, often necessitating operation, but it displays itself in many parts of the body, mental as well as physical.

Common Middle Age Ailments

Here is an important cause for many ailments which heretofore have been simply taken for granted as "old age" symptoms—sciatica, aches in back, legs and feet, frequent nightly risings, nervousness and irritability and frequent dizzy spells indicating high blood pressure; and I learned how, by an astonishingly simple new method, that these disorders would be eliminated in many instances in a short time, without drugs or operation—a treatment that reaches this gland directly—yet is so convenient that any one can apply it in their own home.

10,000 Men Find Relief

But most surprising of all, I find that 10,000 men have already found relief. Statesmen, bankers, lawyers, doctors, in every section of the country are using and endorsing the method. I read many letters. One was from a man in Colorado. "73 years young is my age," he wrote, "yet for years I suffered with prostate trouble. Used medicine to no avail—had about given up hope when a doctor recommended your treatment." Just think of a man 73 years old being restored to the health and buoyancy of youth! And it is within the reach of every one. There are no drugs, no books, no electric rays.



73 Years Young

All Explained in FREE Book

If you are troubled with any of the disorders mentioned, if you have chronic constipation or prostate trouble, you should send for a vitally interesting free book, written by this scientist, called "Why Many Men Are Old at 40." It describes this splendid treatment and shows how you may regain much of your youthful vigor and be free from certain disorders. No obligation. But write at once—the edition is limited. Simply mail request to The Electro Thermal Company, 4031 Main St., Steubenville, Ohio, the concern that is distributing these books for the author.

Mechanics in the Wilds

(Continued from page 153)

New Guinea became the goal of my ambitions. It was one of the few remaining territories where vast areas remained unexplored.

Experience inclined me to concentrate the efforts of the main expedition to Western Papua, a region where the inhabitants still exist in all their lawless, primitive barbarity. I set out for this expedition equipped for every contingency. Two seaplanes and a large light draft vessel, which would serve as a tender, were my units of transport. The personnel comprised six specialists in various branches of science and a large assortment of trustworthy natives. The vessel was fitted with a powerful wireless installation, and the seaplanes with transmitting sets. Our departure base was Port Moresby, Papua.

The tender was given two days' lead in order to reach a predetermined destination in the heart of the swamps 300 miles to the northwest. Upon receiving a wireless that the vessel had reached the objective, the seaplanes set off to effect a junction. No machine had ever flown through these skies before and the effect produced on the native mind was to elevate us to the realms of the supernatural. It was a great moment when we located our vessel through a smoke screen signal and landed beside her in the heart of cannibal territory.

Pigs Sacrificed to "Flying Demons"

The natives deserted the village for a week, until, actuated by curiosity and the sight of abundant presents, they gradually overcame their fears and friendly relations were established. Regarded as gods by these primitive people, we were held in highest reverence, while the machines were regarded with superstitious awe. In order to propitiate our "flying demons," pigs were sacrificed each evening, and amid much ceremony were placed on the cockpits of the machines.

Owing to the extremely turbulent conditions of the upper atmosphere, flying above these swamp regions was fraught with great hazard. The wireless was of incalculable value, and made possible the speedy location of the machine in case of a forced landing. Keeping this highly essential radio equipment in repair gave me frequent opportunities to exercise my ingenuity and mechanical skill, for radio parts are not readily replaced in the jungle.

The engine of our boat also evidenced a striking aptitude for burning out valves. I replaced these as necessity arose with valves I filed by hand from scrap iron, for I had no lathe on which to turn them. Like other light draft vessels, the boat sometimes failed to pump water for its engine, due to the formation of air pockets below it as it rolled. I remedied this difficulty by placing in the water system a sealed drum connected with the pump and the sea and with a pipe extending from the top to above the ock. Atmospheric pressure tended to keep the water level in this drum at the same level as the

(Continued on page 155)

MAKE YOUR FORD INTO SPORT CAR ONLY \$6.40
Other types down to \$3.50. Famous sure fit. **Rebuilt** life-size patterns and picture instructions show how. You can easily convert your Ford into this fast, saucy Sport Car. As hundreds have done with a few dollars worth of material from the hardware store. No need to lay on the car. The "PAL" with conical disc wheel not torn. Pressed Metal Streamline Rear only \$6.40 delivered. Built low. **Keen, Classy Up-to-the-Minute** rides wonderfully easy. Order NOW while we can make good delivery. Send 50 cents for illustrated prospectus of Sport Bodies, "Jiffy" Tops and "Gowum" Windshields. **KUEMPEL CO., 527 Kuempel Bldg., Guttentberg, Iowa**

Squab Book FREE

Squabs selling at highest prices ever known. Greatest market for 20 years. Make money breeding them. Raised in one month. We ship everywhere our famous breeding stock and supplies. Established 23 years. Write now for big illustrated free book. How to Make Money Breeding Squabs. **PLYMOUTH ROCK SQUAB CO. 616 H St., Melrose Highlands, Mass.**

AUTOMOBILE MAKES 27 MILES ON AIR

An automobile goes 27 miles on air by using an automatic device which was installed in less than 5 minutes. The automobile was only making 30 miles on a gallon of gasoline but after this remarkable invention was installed, it made better than 51. The inventor, Mr. J. A. Stransky, 547 Eleventh Street, Pukwana, South Dakota, wants agents and is willing to send a sample at his own risk. Write him today.—Adv.

Learn to Mount Birds

Learn at home to mount birds, animals, game heads; taxidermy, make rugs and robes. Complete lessons. Easily and quickly learned by men, boys and women. **FREE** Write for Free Taxidermy Book. Tells all about it. Every sportsman, trapper and nature lover should know this wonderful fascinating art. Save your trophies. Big profits. Success guaranteed. 25,000 graduates. Investigate. Write for Free Book. **Northwestern School of Taxidermy 4263 Elwood Bldg., Omaha, Neb.**

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—Every Deaf Person Knows That. I make myself hear after being deaf for 25 years with my Artificial Ear Drums. I wear them day and night. They are perfectly comfortable. No one sees them. They stop head noises. Write me and I will tell you a true story, how I became deaf and how I make you hear. Address: **Geo. P. Way Artificial Ear Drum Co., Inc. 86 McKerchey Bldg. 2631 Woodward, Detroit, Mich.**

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Flat or Bullet Nose Radiator. Choice of four colors. Send for complete Catalog of Auto Bodies, Accessories and Speed Power Equipment. Direct from factory.

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CLASS PINS

FREE CATALOG GIVE NAME OF SCHOOL OR CLUB AND NUMBER IN CLASS. Either pin illustrated made with any 3 letters and 2 figures, 1 or 2 colors enamel Silver plate, 25¢ ea., \$2.50 doz. Sterling silver, 40¢ ea., \$4.00 doz. Write for catalog of sterling and solid gold pins and rings. **Bastian Bros. Co. 542 Bastian Bldg., Rochester, N.Y. 3629**

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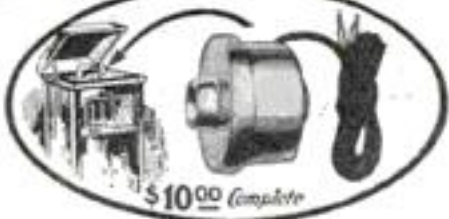
Finest bicycle built—44 styles, colors and sizes. Factory to Rider prices. **FREE** delivery, express prepaid on 30 Days Free Trial. Cash or easy pay'ts. **TIRES** lamps, wheels and equipment at half usual prices. Send no money. Write today for big catalog. Special Factory Prices, free trial plan and marvelous offers.

MEAD CYCLE CO. Dept. F109 CHICAGO

TYPEWRITER BARGAINS!

A real writing machine. Standard keyboard, all improvements, rebuilt like new in Oliver's own factory for a fraction of what you'd expect to pay! Easy terms. Send now for new offer. Act quick, and get yours from 1,000 machines just put through! Address—Rebuilt Machine Dept., **Oliver Typewriter Co. 313 Oliver Typewriter Bldg., Chicago**

Morrison



\$10.00 Complete

Loud Speaker Use Your Phonograph for Radio

To really enjoy radio you require a loud speaker that reproduces all broadcasting in full volume with rattle, vibration and distortion eliminated. Your phonograph has a sound-box that cannot be excelled. So attach a Morrison Loud Speaker to the tone-arm of your phonograph and you have a perfect combination—a scientifically developed loud speaking unit reproducing Radio's wonderful concerts through your phonograph's incomparable sound-box. It is the refinement of radio enjoyment.

A little dial on the Morrison enables you to adjust the tone, soft or loud, to suit your taste. Further than that, Morrison is fool proof—requires no technical skill nor constant adjustment to operate.

This remarkable loud speaker complete with a 5 foot cord costs only

\$10.00

Nickel Plated Model

Every Morrison Loud Speaker is sold on a satisfaction or money-back guarantee. Our 2-color catalogue describes Morrison fully—we would like to send you one free.

DEALERS:

Our merchandising plan to help you sell Morrison Loud Speakers assures you a profitable business. Every sale you make brings many more. Let us tell you about this plan.

MORRISON LABORATORIES, INC.
341 Jefferson Ave. East - DETROIT, MICH.

Mechanics in the Wilds

(Continued from page 154)

sea, so that there was always a water supply for the pump.

We encountered adventures almost innumerable in the wilds of New Guinea. On one occasion, a party of us, visiting an interior village supposedly friendly, was ambushed by bowmen. The chief of the village attempted by ruses to lead us to the place where his bowmen waited. There the savages had stuck poisoned arrows obliquely into the ground, so that if we fled, we would run against them. Becoming suspicious of the wily chief, we retired at last, avoiding the arrow traps and covering the bowmen with our rifles.

The arrows of the natives dropped behind us as we paddled to our boat and sped down the river.

Owing to our constant change of location, it was impossible to house our airplanes and protect them from the weather. After three months' exposure to the rigors of the tropical climate the fabric became so rotten as to make the machines unairworthy. Accordingly, they were flown back to Australia, while the scientific party proceeded up the Fly River into the unexplored heart of the country.

Here a new tribe was discovered dwelling amid the remote reaches of an inland lake, comprehensive scientific work was carried out, ethnological collections secured, and an extensive aerial survey made. The entire scientific records are now in the Australian Museum at Sydney.

In my own career I have found tools so useful that I have reached the conclusion that manual training is an essential course in the curriculum of every primary and secondary school. Schoolmasters are too likely to overlook the fact that nature has endowed the human organism with hands as well as a head.

An early training in practical mechanics is likely to develop individualism and solidity of nature. Whether, in after years, the boy becomes a banker, a lawyer, or just the indispensable clerk, he will find that an early mechanical training has been the least of the many mental encumbrances forced upon him in the days of schoolhood. Anything can be accomplished if you devote yourself to it mechanically and theoretically. The job is done if you always will bear in mind these six words:

Find a way or make one!

Physical Spendthrifts

(Continued from page 44)

amount of muscular work done by a student. The work consists of raising an eight-pound weight attached to one finger. The apparatus, which we call the "ergograph," has one serious defect: It does not really show when a man is tired, for when he is exhausted for eight pounds he can still lift seven pounds and may continue to do so for some time.

The usual procedure is to have several men in turn exhaust themselves for eight pounds, then remove a pound to find that they can lift seven pounds without any serious effort. When they are exhausted for seven pounds they are asked to rest

(Continued on page 156)

The Opinion of 1,000 Others

To find out what influences ambitious men and women to enroll with the American School, an advertising agency sent out a questionnaire to one thousand names, taken at random from our student rolls. The answers to three of these questions show very clearly how our School is regarded by our students, both before and after enrolling.

Why Students Inquired About Our Courses

31.5% wrote only to the American School, because our advertisements impressed them more favorably than the advertisements of other home study schools.

27.0% had heard of the American School before.

23.7% answered several home study school advertisements, so they could select the best.

15.1% were recommended to our school by a friend or acquaintance who had taken one of our courses.

2.7% inquired for various other reasons.

Why Students Considered Taking a Course With Us

37.4% wanted to qualify for better positions.

22.5% wanted assistance in their present work.

20.7% wanted more information on the subject for which they enrolled.

11.2% wanted to prepare for college entrance examinations.

7.4% wanted to "brush up" on subjects previously studied.

.8% enrolled for various other purposes.

What Students Really Think About Our Courses

97.2% say our courses are "Good."

1.4% say our courses are only "Fair."

1.4% say our courses are "Not what they expected."

When you take the average opinion of 1,000 people, selected at random, about some one thing, you will get a definite idea as to the worth of the thing. The average opinion of these 1,000 people is that our courses are O. K. Do you need further proof? If you want to get ahead and are considering a course of practical training, you will find that the American School is the best place to get that training. From us you will get the best grade of training at the lowest cost. And further—

Our Money-Back Guarantee Protects You

You cannot lose when you enroll with us. If after you have finished your course you are not absolutely satisfied, if you do not believe that the training we gave you will help you to get ahead, just write us and we will refund to you every cent you paid us. Mark the coupon. Your request for information puts you under no obligation and no AGENTS WILL BOTHER YOU.

American School

Dept. G-375
Drexel Ave. and
58th St.
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Physical Spendthrifts

(Continued from page 155)

three minutes, whereupon they can again lift eight pounds for a brief period.

In the case of certain unsuspecting individuals we find that, when they can no longer lift eight pounds and they are told that the load is to be changed from eight to seven pounds, a pound can actually be added, making a total of nine pounds, yet their work continues quite as if a pound had been removed.

In such cases the mental attitude toward the work, not the actual load on the muscles, is what determines working capacity. The same influence of mental attitude may be shown at the end of the three-minute rest period after the supposedly seven-pound run. If, instead of increasing the load to eight pounds, two pounds are taken off, reducing the load from nine to seven pounds, the subject acts as if the load were heavier!

Fatigue and rest are generally considered to have an important bearing on infection and disease. Until recently, the weary individual was quite universally believed to be more susceptible to infection than the rested man. In experimental tests on rats and guinea pigs, however, we found in my laboratory, to our great surprise, that exhausted animals survived infection more readily than rested animals.

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One fact stands out clearly. In the recovery process of resting, the muscle regains its energy by chemically combining sugar and phosphate. Both sugar and phosphate are normally present in relatively small amounts in the blood. A German physiologist, Gustav Embden, believing that the sugar-phosphate concentration in the muscle could be increased by feeding a sugar-phosphate mixture, recently conducted a series of experiments with soldiers. The results were amazing. In the most striking experiment, one man was able to do 21.5 per cent more work on eight phosphate days than he did on eight days when he had taken no phosphate.

Phosphate does not work with all people, however. Nevertheless, Embden's results suggest that, when properly administered under the direction of an expert, phosphate may prove to be of tremendous practical importance.

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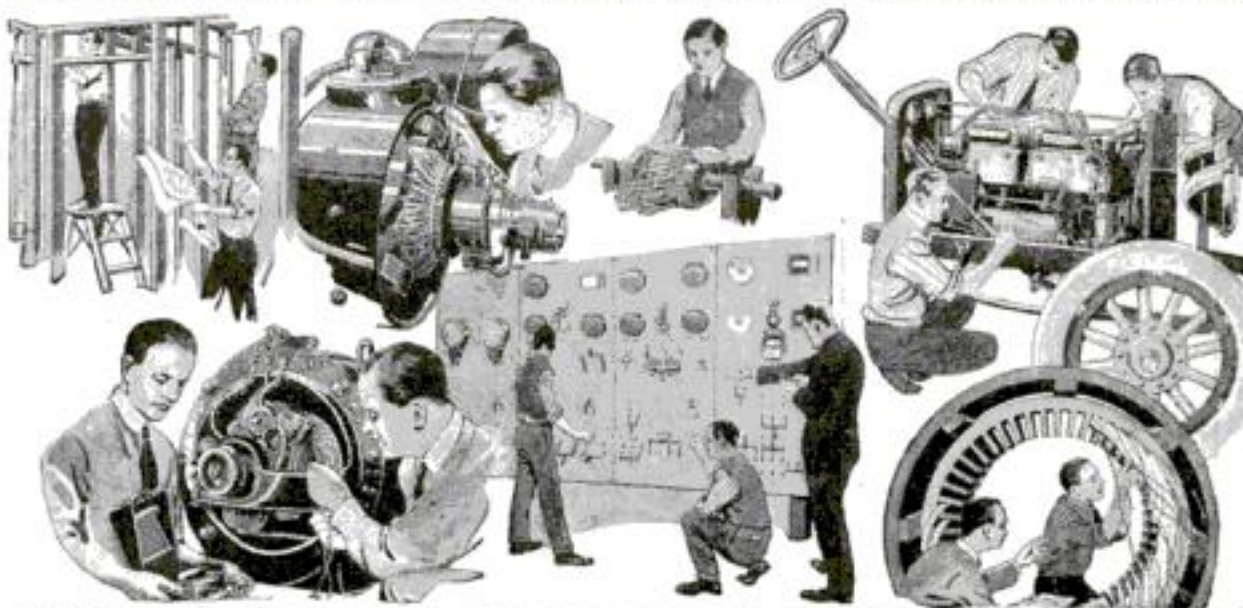
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Here Are the Correct Answers to Questions on Page 58

1. Experiments have shown that the air temperature that is best for brain work, for the white race, is about 65 degrees.
2. In dry weather the surface of the flower becomes tough and the pores close up so that the odoriferous oils cannot get out. After a rain the pores are open and the perfume is more noticeable.
3. No. Criminal tendencies are not indicated surely by anything in the features. The contrary theory was held and defended by the great Italian criminologist, Lombroso, but his views have not stood the test of time and are no longer held.
4. Nearly all storms in the United States move across the continent along the same path. They start in the northern part of the Pacific Ocean, swing southeast across the Western States and then northeast from the Mississippi Valley across the Eastern States into the Atlantic. The weather map shows the path of such a storm and makes it easy to predict the approximate time it will reach a certain place.
5. During your first attack of a disease, the body makes chemicals and some of them remain inside the body. If one of the same kind of germs ever gets in again, the chemicals quickly poison it off.
6. All through the air, even when it is purest, there are many millions of tiny particles of matter. Some are specks of dust, some are water particles, some are the molecules of air itself. All of them are far too small for us to see, but they reflect a little light. This reflected light is of a bluish color.
7. We know of none. Anything done by ancient workmen can be duplicated or improved by modern methods, provided one is willing to take enough trouble.
8. Electricity passes along the nerves. If it is strong enough, it paralyzes the nerves, among them, those that control breathing.
9. In marshes and swampy places, wood and other vegetable matter that become buried in the mud decay and form certain easily inflammable gases. Bubbles of these gases sometimes come to the surface and catch fire when they touch the air. This is supposed to be one cause of the flickering lights called the will-o'-the-wisp. Another may be the living bacteria that produce light much as the fireflies do.
10. Distill it; that is, make steam of it and then condense this steam back into water again. The salt thus is separated from the water.
11. The South American boa constrictor, also called the anaconda or python. Several species of snakes that differ scientifically are included under these common names. Some are 20 feet long.
12. Usually the colors are due to very small amounts of impurities that happen to get mixed in with the mineral crystal while it is forming. For instance, white sapphires, blue sapphires, rubies, and emery powder are all composed of exactly the same material—oxid of aluminum. The white sapphires are nearly pure. The blue ones and the rubies contain very small amounts of certain colored impurities. Emery contains such large amounts of impurities that it is black and opaque.

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In This Issue

	PAGE
Editorial.....	2
Perils of Polar Flight.....	31
By Lieut.-Comm. Fitzhugh Green, U. S. N.	
"My Fellow Scientist—the Rat".....	34
An Interview with Dr. E. V. McCollum	
The Moon's South Pole.....	36
Why Our Habits Make or Break Us.....	37
By James J. Walsh, M.D., Sc.D.	
Mechanics, My Aid in the Wilds.....	40
By Captain Frank Hurley	
New Motorcycle Comforts.....	42
Are You a Physical Spendthrift?.....	43
By Reynold A. Spach, Ph.D.	
Maude Adams as an Inventor.....	45
Wonders in Bridge Building.....	46
The New Mercury Boiler.....	48
"No Place Like a Home on Wheels".....	49
By W. K. Kellogg	
Wall Lining from Waste Lumber.....	51
An Ice-Cream Can Opener.....	51
Street Paved with Rubber Bricks.....	51
How Science Tests Matches.....	52
Machine Measures Full of Horses.....	52
The World's Most Accurate Clock.....	52
University Teaches Airplane Design.....	53
Mechanical Air Filot.....	53
Homemade Camera Photographs Eclipse.....	53
Invisible Writing Made Visible.....	53
An Indoor Football Game.....	54
World's Smallest Fishes.....	54
World's Best Equipped Aquarium.....	54
Notary's Seal Resembles a Watch.....	54
Dentist's Pistol for Filling Teeth.....	54
New Auto Lock Rattles Warning.....	55
Ants Are Topers.....	55
A Fountain Pen for Drawing.....	55
Aerial Dump Car Railway.....	55
Sandpaper Warns of Poison.....	55
A Metal Grip for the File.....	55
Indicator Detects Faulty Spark Plugs.....	56
Gasoline-Driven Railroad Locomotive.....	56
Tiny Portable Electric Fan.....	56
Merchant Invents "Stand-Up" Desk.....	56
Convenient Tray for Berry Picking.....	57
Airplane "Hooks Ride" on Dirigible.....	57
A Two-Piece Tire Rim.....	57
Training Deep-Sea Divers.....	57
Versatile Electric Saw Is Portable.....	58
Miners Ride on Railway Cycles.....	58
Sanitary Crate for Milk Bottles.....	58
To Prevent Doors from Sticking.....	58
How Much Do You Know about Science?.....	58
Gearshift Lever Serves as Pistol.....	59
Novel Collapsible Wheelbarrow.....	59
How Railroads Battle Snowdrifts.....	59
Miners Guided by Smoke.....	59
Foot Plow Hauled by Man Power.....	59
The Progress of Science.....	60
Huge Floating Elevators.....	62
Mechanical Stump Puller.....	62
Seaplane Carried on Submarine Deck.....	62
Motor Drives Blades of New Mower.....	62
Vise Grips Irregular Objects.....	62
Villages Wrecked to Build Reservoir.....	63
New Automatic Steadyrest.....	63
Testing the Balance of Machinery.....	63
Locomotive Turned into Pumping Station.....	64
Cigar Cutter from Old Razor Blade.....	64
Hole in License Plate Foils Thieves.....	64
Trousers Pressed by Electric Valet.....	64
Door Guard Locks Key to Knob.....	64
Tractor Tows 160-Ton Mail Car.....	65
Gasoline Dyed Red for Safety.....	65
Midget Vacuum Clothes Brush.....	65
A Simple Home Shower Bath.....	65
Cigarette Lighter Uses Spark and Benzine.....	65
Fume Masks for Painters.....	65
Lantern Light Is Bait for Fishes.....	66
How to Photograph a Panorama.....	66
Studying Speeding Machinery.....	66
"Lazy Tong" to Hold Heavy Tools.....	67
Garage Doors Opened by Auto.....	67
Moving Sidewalks to Relieve Traffic.....	67
"Ocean Breezes" from Vacuum Cleaner.....	67
Compressed Air Drives Power Shovel.....	67
Where Acres of U. S. Destroyers Rust.....	68
Taking Dictation through Loudspeaker.....	68
Novel Diving Suit from Old Boiler.....	68
New Piano Keyboard to Simplify Fingering.....	68
Radio Tubes for Autos.....	68
Milk-Can Cover Operated by Pedal.....	69
A Handy Pipe Reamer.....	69
Iowa Boy Drives Midget Auto.....	69
Humane Nose Bag for the Horse.....	69
Disk Plow for Breaking Hard Ground.....	69
Radio Watch Sets Itself.....	70
Crystal Set Used as Ashtray.....	70
Police Operate Broadcasting Station.....	70
Simple Clamp as Lightning Protector.....	70
Eiffel Tower Model Holds Radio Set.....	70
A New Variable Condenser.....	70
Secrecy in Directed Radio.....	71
By Jack Binns	
How to Build a Neutrodyne Set.....	73
Approved by Prof. Louis A. Hazeltine	
New Tools for the Housewife.....	74
How to Make a Home Garden Pay.....	76
By Ernest Bade, Ph.D.	
New Additions to Car Enjoyment.....	78
Are Your Headlights Dangerous?.....	79
By F. A. Platte	

The Home Workshop . . . Page 81
Better Shop Methods . . . Page 86

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- ☐ Free bulletin
☐ Agents' proposition
☐ Dealers' proposition
☐ Jobbers' proposition

Name.....

Street address.....

City.....



Radio's finest low-priced receivers

HERE, in the improved MIRACOS, you'll find the same thrill of getting long distances, generally obtainable with only the most expensive and elaborate sets. To the whole family it will furnish entertainment, **unfailingly**, the whole year round—and at an initial price most every family can afford.

It isn't necessary, either, to be an expert at tuning in with the MIRACO. The operation is extremely simple. Scores of users everywhere tell us of the long-distance records they're making—Cincinnati hears 'Frisco, Denver hears Schenectady, New York hears Havana!

Such range as this is made possible through MIRACO'S many new refinements. Improved rheostats with multiple resistance windings enable you to use any type of tube, and a new aluminum shield prevents annoying body capacity effects. Shock absorbing pads prevent tube noises. Fully **GUARANTEED** against defects in material or workmanship. Price for 4-tube outfit shown above only \$54.50.

Other details of MIRACO receivers are explained more fully in our new bulletin. Write today for a copy.

THE MIDWEST RADIO COMPANY

808 Main Street,

Cincinnati, Ohio

The Improved MIRACO

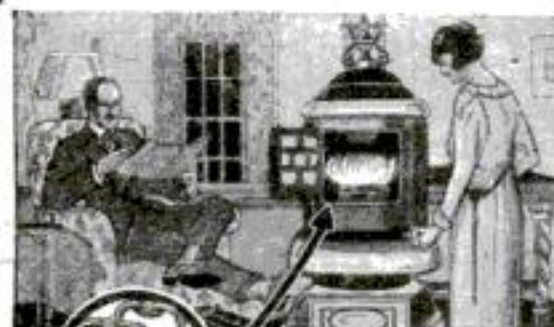
St. Louis Man Discovers New Kind of Heat!



**For Every
Heating Purpose**



Oliver gives much or little heat—steady and even for baking, broiling, frying or boiling—all at the turn of a valve. Better, cheaper, quicker.



No coal—no wood. No dirt—no ashes. The Wonderful Oliver keeps rooms healthfully warm and cozy in coldest winter weather.

BURNS 95% AIR—5% OIL

The Oliver Furnace Burner puts a roaring fire in hot water, steam or hot air plants. You turn it up or down, on or off by simply turning valve.



I need more Salesmen Agents and Distributors

Here is your opportunity to "cash in" on this Nation-wide sweep of oil. Housewives everywhere are clamoring for this amazing new Burner. Oliver agents are making fortunes.

F. W. Bentley, of Phila., says, "Ye gods, some seller! I made \$215 today." J. Carnegie, So. Dakota, writes, "Making \$1000 a month." A. M. Russell, Conn., "Averaged \$660 for last six months." R. Berger made \$258 per week. Mrs. Selder, Kans., made \$100 a month, spare time only in her own home.

I want men and women of every type. If you want to earn \$40 to \$50 a week in spare time, write me. If you can give all your time as a salesman and want \$200 to \$250 a week, write me. If you can swing a whole territory and want \$5,000 to \$15,000 a year, wire me at my expense for sales plan and how you can get an exclusive franchise for your territory. But act at once if you want to "cash in" on this great new fuel idea.

Write today for sales plan and free book "New Kind of Heat." Address me personally, B. M. Oliver, President, at address shown above.

Amazing New Invention Does Away With Dirty Coal and Wood

No more fires to build, bank or watch—no more dirty, heavy coal to carry and lift—no more clouds of ashes to breathe, or back-breaking scuttles to empty—no more heating problems—no more cold rooms in Winter—no more suffering from lack of quick fires in uncertain Fall and Spring—no more sweltering kitchens in hot summer weather since this Wonderful New Invention.

Twice the Heat of Coal by simply turning valve

Here is the amazing new kind of heat that has ended forever the days of woman's slavery to household drudgery. Why should any woman give her best strength and energy in endless back-breaking servitude to a hot, mussy heater, cook stove or furnace? Why should anyone worry about coal shortages and high prices? No need for that now. The wonderful invention of Mr. B. M. Oliver, of St. Louis, in one minute turns any coal or wood burner into a modern, up-to-date gas stove. It gives as much or little heat as wanted by simply turning a valve.

Cheaper than coal or wood

Mr. Oliver calls his invention the Oliver Oil-Gas Burner, because it uses 95% air and only 5% coal oil (ordinary kerosene, the cheapest fuel there is) turning them into an actual gas that burns with an intensely hot, clean flame. No wicks, no smoke, no odor.

Fits all stoves—any kind or size

Mr. Oliver's wonderful invention is made in sixteen different models to fit any kind of cook stove, heating stove or furnace. No holes to drill, no bolts to fasten, no change whatever in your stove. Simply sets in the firebox. Easily slipped in, in one minute. Absolutely safe. It lasts a lifetime.

Oliver protects your home

You can absolutely depend upon your Oliver to heat your rooms in coldest Winter weather—it gives twice the heat of coal or wood. Physicians recommend it as the surest safeguard against chill, colds, pneumonia, influenza and other sickness. The even, steady, odorless and dustless heat protects your health. It saves its cost in cleaning bills alone. No more hot summer kitchen. The Oliver gives you cooking or baking heat instantly. Turn the valve and heat is off.

No wonder housewives are clamoring for this wonderful device. No wonder we receive

letters like these. Mrs. W. N. Spencer, of Connecticut, writes: "The Oliver works like magic. It is wonderful to have quick heat and no work." Mr. Elijah McCleave, of Virginia, says: "It works fine. All my friends want one. I will get their orders." A letter from Mr. S. K. Pedro, of South Carolina, says: "Beats all other burners seen in this county. A sensation." Mr. Geo. Flynn, of Michigan, writes: "It is cleaner, cheaper, hotter and steadier than coal or wood. Only cost me \$5.00 for two months."

Special Low Introductory Price

Now, once and for all, do away with household dirt and drudgery. End ashes, dirt, smoke, odor, chopping, shoveling, carrying dirty, heavy coal and wood. The Oliver in your stove, heater or furnace saves hours of work. Send immediately for the free attractive Booklet, "New Kind of Heat," telling all about this amazing new invention. Shows exactly how it works, how it is different from all other burners, how it will relieve you of the back-breaking work of coal and wood fires. And if you send immediately you will be in time to get a Special Low Introductory Price Mr. Oliver is now making to the readers of this magazine. Even if you do not buy now you should not miss the opportunity to become entitled to this low price should you wish to buy later, by writing at once.

Mail Coupon for Free Offer

Don't send a cent. You can get this interesting Free Book and full information, without obligation. But don't delay. To get this big special offer you must act quick. Fill in and mail the coupon now.

OLIVER OIL-GAS BURNER

OLIVER OIL-GAS BURNER COMPANY

Oldest and largest manufacturers of oil-gas burners in the world

C-54 Oliver Building St. Louis, Mo.

Canadian Distributors, C-54 Oliver Bldg., Toronto, Ont.

OLIVER OIL-GAS BURNER CO., C-54 Oliver Bldg., St. Louis, Mo.

Without obligation, send me your FREE book "New Kind of Heat" and Special Low Price Introductory Offer. I am interested in the burner for a

☐ Coal Range ☐ Heating Stove ☐ Furnace
Specify steam, hot air or hot water

Name.....

Address.....

City..... State.....

★ RICH GOLD GIRDLE REINFORCES CAP—WAS \$1 EXTRA—NOW FREE



Rivals the
beauty of the Scarlet
Tanager

How we save you \$3

Yet Guarantee Point 25 Years

*As High as \$2500 in Gold Dust
Reclaimed from Factory Sweepings*

Even Greater Savings Made Through Large Production

FOR months we've been shipping up to 10,000 and 12,000 Parker pens a day. We could sell more if we could make them—indeed demand seems boundless. But Duofold craftsmanship cannot be turned on in any quantity like water.

Every Iridium tip, for example, is skillfully fused in the extra thick gold point by hand. Then it's polished to a jewel-like smoothness, and this is slow—for this tip is the hardest metal known.

Five times every point is inspected by experts. And each pen is filled with ink and written with, before the final O. K.

Equal skill, equal care, go into other Duofold parts right up to the last loving touch—the handsome ★ Gold Girdle that reinforces the cap. This Girdle was \$1 extra—now free—due to savings made by large production and efficiency.

Look—to reclaim the gold dust, we wash employes' clothes, and save factory

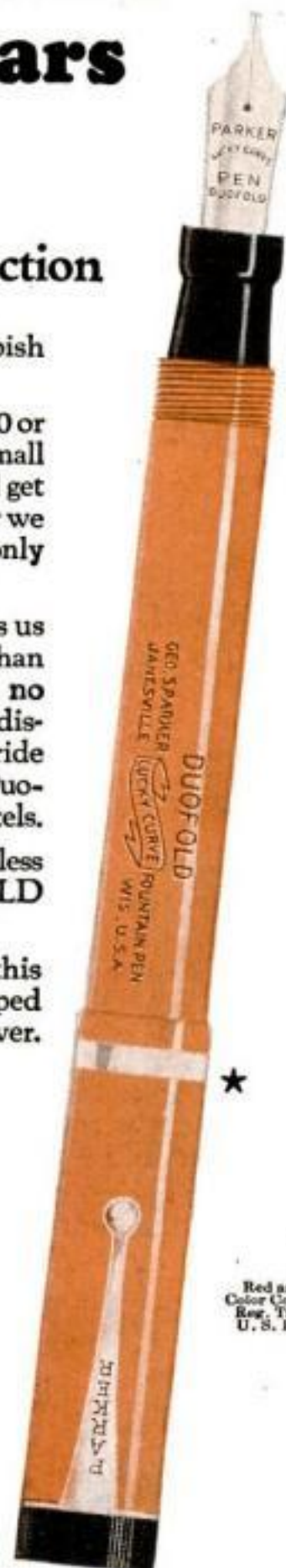
sweepings. Recently, here, one rubbish heap yielded us \$2500 in gold.

Yes, Parker Duofold would cost \$10 or more if made in ordinary ways and small quantities. You virtually save \$3, and get the most economical pen on earth. For we guarantee the point for 25 years—not only for mechanical perfection, but *wear!*

The polished Iridium tip alone costs us \$2340 a pound—three times more than ordinary. It suits all hands. It needs no “breaking in.” No style of writing can distort it—hence a pen you can lend with pride—not fear. That's why the Parker Duofold is used to register guests in fine hotels.

No pen is a genuine Duofold unless stamped—“Geo. S. Parker—DUOFOLD—Lucky Curve.” Look carefully.

Good pen counters will sell you this classic on 30 days' approval—black-tipped lacquer-red, or flashing black all over. Don't miss it.



Red and Black
Color Combination
Reg. Trade Mark
U. S. Pat. Office

Parker Duofold

LUCKY CURVE

With The 25 Year Point

Duofold Jr. \$5 Same except for size

Lady Duofold \$5 With ring for chatelaine

OVER-SIZE \$7

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NEW YORK • CHICAGO Manufacturers also of Parker “Lucky Lock” Pencils SAN FRANCISCO • SPOKANE
THE PARKER FOUNTAIN PEN COMPANY, LIMITED, TORONTO, CANADA



No. 125
BENCH LATHE

A bench lathe for your home shop



Have a *real* workshop—one where you can do all sorts of turning or boring jobs yourself.

This bench lathe is just the right size for you. Length over all, 25 inches; height, 11½ inches; swing, 7 inches; extreme distance between centers, 12 inches. Weighs only 30 pounds.

Well-made and finished with black and red enamel. The bed is milled. All working parts handsomely polished. Cone pulley has

three steps—1½, 2½ and 3½ inches in diameter.

Included with this lathe are an adjustable tee rest, slotted face plate, saw arbor, drill chuck and a No. 1 Morse taper shank.

This bench lathe is just one of the many tools made by Goodell-Pratt for the craftsman. Write for the Goodell-Pratt Catalog. It illustrates and describes each of the 1500 Good Tools. A postcard will bring a copy—free.

No. 125 Bench Lathe

PRICE \$36

No. 132 Slide Rest

PRICE \$16

No. 130 Counter Shaft

PRICE \$11

DEALERS: Write for prices, terms, etc., on this popular bench lathe, as well as on other Goodell-Pratt Tools

GOODELL-PRATT COMPANY, GREENFIELD, MASS., U. S. A.

Toolsmiths

MAKERS OF MR. PUNCH

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1500 GOOD TOOLS